

Reducing Outpatient Antibiotic Resistance: A Quasi-Experimental Study

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Abstract

Approximately 50% of antibiotics prescribed are not necessary, nevertheless in the United States among the many outpatient prescriptions, few are more widely prescribed than antibiotics. The inappropriate use of antibiotics to treat non-bacterial infections has been largely responsible for the emergence of antibiotic resistance. The purpose of this DNP project was to evaluate the effect of an antibiotic stewardship program on urgent care providers' antibiotic prescribing for acute respiratory infections and to analyze providers' awareness and beliefs regarding antibiotic use and resistance. A quasi-experimental study was conducted among a convenience sample of eight urgent care providers who received a one hour theory-based intervention program on antibiotic prescribing. Outcomes measured included provider antibiotic prescribing rates pre- and post-intervention, differences in antibiotic prescribing among the providers, and provider attitude and knowledge regarding antibiotic prescribing and resistance. The antibiotic prescribing rate decreased from 30% to 20% post-intervention, $p = .078$. The odds ratio of nurse practitioners preferring not to prescribe antibiotics pre-intervention was 3.273 ($p = .001$) and post-intervention 4.155 ($p = < .0005$) times more than physicians. Within their setting, 84.43% believed antibiotics are overused, and 92.25% believed antibiotic resistance is a problem. Implementation of an outpatient antibiotic stewardship program is necessary to decrease inappropriate antibiotic prescribing, slow progression of antibiotic resistance, and decrease healthcare costs associated with this world-wide public health problem.

Keywords: academic detailing, antibiotic resistance, antibiotic overuse, acute respiratory tract infections, antibiotic stewardship, knowledge, attitude and practice surveys, intervention, outpatient

Reducing Outpatient Antibiotic Resistance: A Quasi-Experimental Study

Antibiotic resistance is a phenomenon that happens when an antibiotic loses the ability to successfully eradicate bacterial growth (Institute of Medicine [IOM], 2010), which was identified as early as 1940 with penicillin-R *Staphylococcus* prior to the widespread use of penicillin in 1943 (Centers for Disease Control and Prevention [CDC], 2013). The emergence of drug-resistant bacteria can be attributed to the evolution of microbes and to inappropriate use of antibiotics to treat non-bacterial infections (Agency for Healthcare Research and Quality [AHRQ], 2014; CDC, 2013; Charani et al., 2011; Van Boeckel et al., 2014). Antibiotic resistance is a worldwide community health crisis reducing the efficacy of antibiotics to adequately treat infections, increasing patient mortality and skyrocketing healthcare costs (CDC, 2013; Center for Disease Dynamics, Economics & Policy, 2015; IOM, 2010; World Health Organization [WHO], 2014). To preserve antibiotic effectiveness and decrease antibiotic resistance, coordinated interventions involving healthcare providers can be provided through antibiotic stewardship programs (CDC, 2013; Griffith, Postelnick, & Scheetz, 2012).

Significance of Antibiotic Stewardship

Overuse of antibiotics in healthcare has become an increasingly costly problem within the United States contributing to the high costs of healthcare and subjecting patients to unwarranted adverse events and health risks (Berwick & Hackbarth, 2012; Powell, Bloomfield, Burgess, Wilt, & Partin, 2013). Acute respiratory infections (ARI), typically viral in nature, are some of the most common illnesses presenting to outpatient providers (Harris, Hicks, & Qaseem, 2016). In 2011, there was an estimated 4.6 million emergency department (ED) and 3.3 million outpatient visits for ARIs with the number of antibiotic prescriptions totaling almost 9.3 million (CDC, 2014a, b, c, d). In 2012, an estimated \$1 billion of US healthcare spending was incurred through

antibiotic prescriptions (IMS Institute for Healthcare Informatics [IMS Institute], 2013). In the United States, antibiotic resistant infections represent over 2 million illnesses and at least 23,000 deaths yearly (CDC, 2013), leading annually to \$35 billion in lost wages and an excess of 8 million unnecessary hospital days, costing the healthcare system more than \$20 billion a year (CDC, 2011). Due to the increase in antibiotic use and resistance, healthcare costs, and patient disability and mortality, aggressive action is necessary to prevent the spread and the development of new antibiotic resistance (CDC, 2013). Therefore, in March 2015, the Interagency Task Force on Antimicrobial Resistance presented the *National Action Plan for Combating Antibiotic-Resistant Bacteria* providing a roadmap to detect, prevent, and control antibiotic resistance by guiding activities to improve antimicrobial stewardship to reduce outpatient inappropriate antibiotic use by 50% by 2020 (The White House, 2015).

Local Issue

Urgent Care providers attend to numerous patients with ARIs on a yearly basis. According to the National Hospital Ambulatory Medical Care Survey (NHAMCS), in 2011, ARIs accounted for 3.5% of people in the ED and 2.6% of people in outpatient facilities (CDC, 2014c; CDC, 2014d). At the project site institution, during 2015, approximately 31,780 people were seen in the ED and 101,991 people seen in the seven urgent care facilities (Hospital, 2015). Using the percentages from the NHAMCS, approximately 1,112 patients seen in the ED and 2,652 patients seen in the urgent care facilities were possibly diagnosed with ARIs. At the project site facility, there is no formal educational seminar for healthcare providers regarding antibiotic stewardship. The student investigator contends that development and utilization of an outpatient antibiotic stewardship program would promote judicious use of antibiotics for ARIs by healthcare providers within urgent care centers and EDs.

Diversity Considerations

Healthcare providers come from diverse backgrounds and possess a mixture of customary beliefs, practices and attitudes that can impact the quality of patient care (Lehman et al., 2012). The eight urgent care centers to be studied are staffed by 59 healthcare providers consisting of 24 physicians (MDs) and 35 nurse practitioners (NPs), and each provider has different levels of training and years in practice. The DNP study evaluated whether there was a difference in the antibiotic prescribing habits and knowledge of antibiotic resistance and antibiotic decision making process between NPs and MDs.

Problem

Approximately 50% of antibiotics prescribed are not necessary (AHRQ, 2014; CDC, 2013), nevertheless, in the United States among the many outpatient prescription medications, few are more widely prescribed than antibiotics (Gerber et al., 2013; Lee et al., 2014). Between 2000 and 2010, global consumption of antibiotics increased by 36%, and the United States was the third largest consumer with an estimated 9.2% of global consumption (Van Boeckel et al., 2014). Lee et al. (2014) revealed in the United States from 2000 to 2010 that approximately 3.1 billion outpatient ARI visits occurred with an estimated 1.4 billion outpatient antibiotics prescribed and ARIs accounted for 75% of all antibiotics prescribed by office-based providers. Most antibiotic use occurs in the outpatient setting; therefore, it is imperative to understand factors which influence prescribing decisions, apply antibiotic stewardship principles to ambulatory care settings, decrease inappropriate antibiotic prescribing, slow progression of antibiotic resistance, and reduce healthcare costs associated with this global public health problem.

Intended Improvement, Purpose

Antibiotic resistance is commonly ignored because many healthcare providers do not regard this problem as an important priority in practice (Bekkers et al., 2010). Inappropriate use of antibiotics can be associated with healthcare providers' lack of knowledge, attitudes regarding antibiotic use and resistance, and intrinsic or extrinsic factors that can influence prescribing decision-making (Gaur & English, 2006; Rezal et al., 2015). The *Reducing Outpatient Antibiotic Resistance (ROAR)* theory-based intervention is an evidence-based DNP project created to reinforce providers' confidence by enhancing knowledge in their ability to manage ARIs without antibiotics. The purpose of this DNP project was two-fold: to evaluate the outcome of an antibiotic stewardship program on urgent care providers' antibiotic prescribing for ARIs, and to analyze providers' awareness and beliefs regarding antibiotic use and resistance.

Facilitators & Barriers

There were a few factors that facilitated success of the DNP project which included effective communication of the vision and goals of the DNP project by the student investigator and support from DNP preceptor. Challenges to the DNP project's success included the providers' resistance to change, feeling no benefit to themselves or to patient care, and sensing lack of time with patients to implement strategies. Other barriers from management included the possibility of a decrease in patient satisfaction and taking time away from patients' care. The ROAR antibiotic stewardship program is sustainable because it is cost effective, simply formatted, easy to duplicate, generalizable to other outpatient facilities, and does not require a multidisciplinary team.

Review of the Evidence

PICOTS

The aim of this DNP project was to reinforce providers' confidence by enhancing knowledge in their capability to manage ARIs without antibiotics. In healthcare providers at urban urgent care centers, does an antibiotic stewardship program *Reducing Outpatient Antibiotic Resistance* compared to the current practice of no program reduce the prescribers' inappropriate use of antibiotics to treat ARIs and change healthcare providers' knowledge and attitudes regarding antibiotic use and resistance within two months following the antibiotic stewardship program?

Literature Search

Relevant studies and guidelines were identified by searching Cochrane Database of Systematic Reviews, Cumulative Index to Nursing and Allied Health Literature (CINAHL), National Guideline Clearinghouse, Ovid Medline, and PubMed databases for English language studies or guidelines published between 2007 and 2016. Additional studies were obtained by reviewing research that was cited by the studies appearing in the preliminary search. Selection criteria included human subjects of all ages, quantitative or qualitative, and all medical healthcare providers. The search was expanded to include studies performed by countries other than the United States. Interventions excluded delayed prescribing, restriction policies, financial incentives, point-of-care lab testing only, or patient education alone. The search strategy used Boolean operators for combinations of several keywords to identify relevant articles. The keywords used in the search included the following: antibiotic or antimicrobial, resistance, acute or upper respiratory tract infection and illnesses, unnecessary or overuse or inappropriate use, ambulatory or outpatient or primary or urgent or emergency care, knowledge and attitude and practice (KAP) survey, healthcare provider, physician, nurse practitioner, stewardship,

intervention, prescribing behavior, decision making, evidence based guideline, computer decision support, academic detailing, audit, feedback, and communication skills.

Evidence

From this search, 31 studies were included in the integrative review (see Appendix A1 and A2). The studies were methodologically diverse: two evidence-based guidelines, three systematic review of quantitative studies, eleven quantitative randomized control trial, seven quantitative quasi-experimental, one quantitative cohort, one systematic review of quantitative and qualitative and mixed methods studies, three systematic reviews of qualitative studies, and three quantitative descriptive. The 31 studies were separated into hierarchies of evidence level one through seven according to Melnyk and Fineout-Overholt (2015): five level I, 11 level II, seven level III, one level IV, four level V, three level VI, and zero level VII.

Providers' Knowledge, Attitude and Perceptions Regarding Antibiotic Use and Resistance

According to the literature, most healthcare providers are aware of antibiotic resistance (Abbo et al., 2011; Abbo, Smith, Pereyra, Wyckoff, & Hooton, 2012; McCullough, Rathbone, Parekh, Hoffmann, & Del Mar 2015; Rezal et al., 2015) in which 98% deem it to be serious (McCullough et al., 2015), 89% believe it is a global problem (McCullough et al., 2015), and 92% to 94% believe it is a national problem (Abbo et al., 2011, 2012; McCullough et al., 2015). Most, 94% to 98%, believe inappropriate use of antibiotics cause resistance (Abbo et al., 2011, 2012; McCullough et al., 2015). Providers were found to have inadequate knowledge about antibiotic prescribing (Abbo et al., 2011, 2012; Rezal et al., 2015), underestimate antibiotic resistance (Rezal et al., 2015), and some feel antibiotic resistance is a lower priority than their immediate patient needs (McCullough et al., 2015).

Factors Influencing Provider Antibiotic Prescribing Behavior

The literature review revealed improper antibiotic prescribing has been linked to several indirect, extrinsic and intrinsic factors. Indirect factors include provider uncertainty of diagnosis (Rezal et al., 2015; Rodrigues, Roque, Falcao, Figueiras, & Herdeiro, 2013) and lack of effective communication skills (Rodrigues et al., 2013). Extrinsic factors include patient signs and symptoms present at time of visit (Lopez-Vazquez, Vazquez-Lago, & Figueiras, 2011; Rodrigues et al., 2013), serious or critically ill patient (Abbo et al., 2011, 2012; Rezal et al., 2015), and decreased patient visit time (Rodrigues et al., 2013; Sanchez, Roberts, Albert, Johnson, & Hicks, 2014). The most influential intrinsic factors included fear of missing infection (Abbo et al., 2011, 2012), fear of patient complication (Lopez-Vazquez et al., 2011; Rodrigues et al., 2013; Sanchez et al., 2014), and provider complacency or perception that patient wants antibiotics (Lopez-Vazquez et al., 2011; Rezal et al., 2015; Rodrigues et al., 2013; Sanchez et al., 2014).

Evidence-Based Guidelines

Guidelines focused on ARIs among adults (Harris et al., 2016) and adults and children (Snellman et al., 2013) and assist providers in managing illnesses by detailing symptoms and differential diagnoses. The guidelines help reduce unnecessary antibiotic use and improve first line antibiotic use for antibiotic appropriate infections by providing treatment recommendations and fostering provider-patient communication by providing tips and comfort measures to convey to patients.

Antibiotic Stewardship Interventions

Drekonja et al. (2015) performed a systematic review evaluating outpatient antibiotic stewardship programs and found that 40 of 55 interventions produced low- to moderate-strength evidence associated with improved antibiotic prescribing. However, Ranji, Steinman, Shojania, and Gonzales (2008) performed an analysis among 30 ambulatory care stewardship intervention

trials, reporting a median decline in antibiotic use of 9.7%. which is equivalent to 25% relative reduction. A systematic review by van der Velden et al. (2012) of 87 outpatient interventions focused on antibiotic use for ARIs and found that 60% of the interventions effectively enhanced antibiotic prescribing with a 11.6% overall antibiotic prescription reduction. Two of the systematic reviews reported that multifaceted interventions using provider education are more effective in reducing antibiotic prescribing than single strategy interventions (Ranji, Steinman, Shojania, & Gonzales, 2008; van der Velden et al., 2012).

Computer decision support system. Interventions that embed algorithms within the electronic health record allow clinicians to review treatment strategies (CDC, 2015b). Jenkins et al. (2013) showed an 11.2% relative reduction ($p < .0001$), and Gonzales et al. (2013) showed a 13.3% absolute reduction ($p = 0.014$) in antibiotic prescribing for ARIs. The use of broad-spectrum antibiotics for ARIs decreased 16.5% in both children and adults ($p < 0.05$; Litvin, Ornstein, Wessell, Nemeth, & Nietert, 2013) and 16.6% in adults and 19.7% in children ($p < 0.0001$; Mainous, Lambourne, & Nietert, 2013), and unnecessary antibiotic prescriptions reduced from 22% to 3.3% ($p < 0.000$; Rattinger et al., 2012).

Academic detailing. Interventions that provide detailed clinician education (CDC, 2015c) revealed, in overall antibiotic prescribing rate, an absolute reduction of 13% in adults ($p < 0.001$; Grover et al., 2013), 10% in all ages (ratio of *OR* 2.60, 95% CI [1.23, 5.48]; Vinnard et al., 2013), and 4.2% in all ages ($p = 0.02$; Butler et al., 2012). Regev-Yochay et al. (2012) showed a 40% decrease in antibiotic prescription rate (relative risk 0.76, 95% CI [0.75, .078]) and parent's wish for antibiotics decreased 47%. Gerber et al.'s study (2013) decreased broad-spectrum antibiotic use 12.5% ($p = 0.01$).

Guidelines. Interventions that include provision of evidence-based guidelines to healthcare providers to assist in clinical treatment showed a decrease in inappropriate antibiotic use of 9.8% (19.7% absolute reduction relative to control, $p = 0.02$) during the intervention period (Meeker et al., 2014) and antibiotic prescribing rates decreased 4.2% ($p = 0.002$) immediately after dissemination of the guidelines (Weiss, Blais, Fortin, Lantin, & Gaudet, 2011). Venekamp, Rovers, Verheij, Bonten, and Sachs (2012) found antibiotic prescription rate declined from 62 per 100 patient episodes to 56 per 100 patient episodes ($p < 0.05$).

Feedback. Interventions using feedback allow the healthcare provider to view a summary of their antibiotic prescribing rates over a specified period (CDC, 2015d). Gjelstad et al. (2013) noted a reduction (33.2% to 31.8%) of antibiotic prescribing rates (adjusted OR 0.72, 95% CI [0.61, 0.84]), yet their intervention included other methods. Linder et al. (2012) found no difference in antibiotic prescribing rate between a control and intervention group, which was attributed to the lack of tool usage; but those who utilized the tool were less likely to prescribe antibiotics ($p = 0.02$). Naughton, Feely, and Bennett (2009) saw a 2% reduction ($p = 0.04$) in antibiotic prescribing; however, the improvement returned to the pre-intervention rate 12 months after the intervention due to lack of participation and follow up.

Communication skills training. Interventions enhancing healthcare providers' communication skills with patients to address patient expectations (Llor & Bjerrum, 2014). Little et al. (2013) showed a decrease of antibiotic prescribing by 9% ($p < 0.0001$), Altiner et al. (2007) showed a decrease of antibiotic rates by 60% six weeks following intervention ($p < 0.001$) and remained at 40% reduction one year later ($p = 0.028$), and Légaré et al. (2012) revealed a 14% decrease in patients' decision to use antibiotic after consultation (adjusted

relative risk 0.48, CI 95% [0.34, 0.68]) with patients more involved in decision-making ($p < 0.001$).

Theory

The goals of Icek Ajzen's theory of planned behavior (TPB) are to understand motivational influences on behavior and identify how and where to target strategies for changing behavior (Ajzen, 1991; Montañó & Kasprzyk, 2008). An individual's intention to carry out a behavior is a combination of one's attitude towards the behavior, beliefs about whether other important individuals approve of the behavior, and perception of one's capability to perform the behavior (Ajzen, 1985, 2002, 2012; Montañó & Kasprzyk, 2008). Changing behavior will require changing the individual's intentions by identifying the beliefs that support them (Ajzen, 2012; Walker et al., 2001).

The TPB has been found to be an appropriate theory to explain and predict behavior along with containing specific elements allowing the ability to predict the use of antibiotics to treat ARIs (Glanz et al., 2008; Eccles et al., 2007; Godin et al., 2008). Butler et al. (2012) utilized an educational program based on the TPB and social cognitive theory in the United Kingdom resulting in a 4.2% reduction of antibiotics dispensed. The Antibiotic Smart Use program in Thailand utilized a TPB theory-based antibiotic stewardship program resulting in an 39% to 46% decrease in antibiotic use in primary care centers with a 12.9% decrease in antibiotic use for ARIs (Sumpradit et al., 2012; WHO, 2012). The *ROAR* educational program was modeled after the TPB and designed to change provider antibiotic prescribing by addressing beliefs that influence behavior and intentions of performing the behavior (see Appendix B). The multifaceted intervention includes five components designed to affect corresponding salient

beliefs: provider education, evidence-based practice guidelines, audit and feedback of providers' rates of antibiotic prescribing, provider communication skills training, and patient education.

Methods

Institutional Review Board and Site Approval

The DNP research proposal was submitted and approved July 25, 2016 by the Institutional Review Board (IRB) at the study site hospital for research involving human subjects (see Appendix C). The research was found to have minimal risk to provider participants and patients and required data collection from patient electronic medical records (EMR); hence, an expedited review by IRB was granted. Site approval for the DNP project was obtained from the directors overseeing the urgent care centers (see Appendix D).

Funding and Ethical Issues

Funding for the DNP study was not obtained and the total cost for the project, \$1128.00, was financed by the student investigator (see Appendix E). Informed consent from each healthcare provider participant was obtained and included information about the research, potential risks and benefits associated with the research, and voluntary participation. Data collected from the patient EMR did not include personal information, was coded to conform with Health Insurance Portability and Accountability Act (HIPAA), and was stored on an encrypted USB flash drive to limit breach in confidentiality. All information from the EMR had a code assigned for the provider and patient and was kept independent of the data spreadsheet. The provider questionnaire data was captured via an online secure database and de-identified as to not associate responses to an individual provider.

Setting and Participants

The quasi-experimental study involved NP and MD providers and patient charts from a network of eight Missouri hospital-owned urgent care centers. The centers are located within different urban and suburban regions across the large metropolitan area and serve children and adults of diverse racial and socioeconomic backgrounds. The urgent care centers, staffed by 35 NPs and 24 MDs, provide corporate health care and services to those seeking treatment for less critical or severe illnesses and injuries which require immediate care 365 days a year. For the study, a convenience sample of 35 board-certified urgent care NPs and MDs, without any exclusion criteria, was expected to participate in the study.

EBP Intervention

Pre-intervention chart review. Prior to the intervention, a baseline rate of incidence for antibiotic prescriptions was determined by performing a retrospective chart review of 150 charts of patients who sought care for ARIs at the urgent care centers from October 1, 2015 to December 31, 2015. Information was collected by the student investigator from the patient EMR noting date of service, clinic site, provider and type, patient age, sex, past medical history, antibiotic allergies, duration of illness, diagnostic tests performed with results, antibiotic prescribed, and antibiotic name.

Recruitment. All NPs and MDs practicing at the eight urgent care centers were invited to participate in the study through recruitment flyers posted in the urgent care centers and sent via email (see Appendix F). Within two weeks of the flyers being distributed, the student investigator followed up with providers to assess interest in the study (see Appendix G). The providers were informed that they would be in the research study for a total of three months and would be required to complete a questionnaire and attend or view a one hour continuing education program. In return, the providers would receive a \$25 gift card and those who

attended the live session and filled out presentation evaluation (see Appendix H) would also receive *1.0 AMA PRA Category 1 CreditsTM*. The providers interested in voluntarily participating in the research study signed an informed consent and privacy authorization form (see Appendix I).

Questionnaire. One month prior to the intervention, utilizing the online secure REDCap (Vanderbilt University, 2016) database, the student investigator emailed a link to a questionnaire designed by Rodrigues et al. (2016) to assess knowledge and attitudes influencing antibiotic prescribing behavior and collect provider demographic data noting age, gender, type of provider, number of years practicing, years at an urgent care center, approximate number of patients seen per day, and average time spent with patients (see Appendix J).

Intervention. Clinical educational sessions were delivered by the student investigator onsite live twice, and a video presentation on YouTube via REDCap. The presentation included objectives of the program; updates on problem and significance of antibiotic resistance and overuse of antibiotics; global, U.S., and Missouri antibiotic use; U.S. outpatient and the study's urgent care centers antibiotic prescribing rates; acute respiratory infection facts; updates regarding current guidelines on acute respiratory infections; antibiotic stewardship initiative with goals of the study; and patient communication strategies (see Appendix K). The providers were given a packet of information including a copy of the program slides, feedback from baseline chart audit, evidence-based practice guidelines for common ARIs from the California Medical Association's Alliance Working for Antibiotic Resistance Education program (AWARE; California Medical Association, 2016; see Appendix L1), patient education brochures from the CDC *Get Smart* program (CDC, 2015e; see Appendix L2), and Michigan Antibiotic Resistance

Reduction Coalition (MARR) Clinical PEARLS (Michigan Antibiotic Resistance Reduction Coalition, 2004; see Appendix L3).

Reminders. Within two months after the intervention, participants were emailed on four separate occasions reminders of appropriate antibiotic use every 2 weeks (see Appendix M).

Post-intervention chart review. The student investigator performed a review of 156 charts of patients who sought care for ARIs at the urgent care centers between November 1, 2016 to December 31, 2016. Post-intervention data included information from the patient EMR noting date of service, clinic site, provider and type, patient age, sex, past medical history, antibiotic allergies, duration of illness, diagnostic tests performed with results, antibiotic prescribed with antibiotic name. The post-intervention results were compared to the baseline results to determine if there had been a decrease in healthcare provider antibiotic prescribing for ARIs (see Appendix N).

Change Theory and EBP Model Assisting DNP Intervention

Kurt Lewin's change theory provides a process to facilitate change through phases of unfreezing, moving, and freezing (Lewin, 1947, 1958). Unfreezing requires recognizing the need for change and seeking other ways to do things, moving requires creating new through teaching, and freezing entails reinforcing and sustaining the new change. (Broud, Hatch, Corniea, Rice, & Mickelson, 2013). The DNP project followed Lewin's three phase process (see Appendix O). Unfreezing was represented by presenting evidence regarding antibiotic resistance and need to change, assessing factors influencing antibiotic prescribing behavior, determining baseline antibiotic prescribing rates, and providing feedback to the providers. Moving was addressed by presenting the *ROAR* educational program. Freezing entailed providing post-

intervention antibiotic prescribing rate results to providers and sending out reminders regarding judicious use of antibiotics.

The *Iowa Model of Evidence-Based Practice to Promote Quality Care* (Titler et al., 2001) was utilized as a framework to navigate change to reduce healthcare providers antibiotic prescribing for ARIs and allow integration of an antibiotic stewardship into clinical practice.

The DNP project followed the Iowa model's seven steps: (1) selecting an issue, (2) establishing a team, (3) retrieving relevant research evidence and related literature, (4) critiquing, grading and synthesizing the research evidence, (5) designing evidence-based practice guidelines, (6) implementing evidence-based practice as a pilot, and (7) evaluating the pilot, practice changes and disseminating results (Doody & Doody, 2011; Titler et al., 2001; see Appendix P).

Employing a logic model that incorporated concepts from Titler's Iowa Model provided an operational blueprint for the DNP project (see Appendix Q).

Study design

The quasi-experimental study, pre- and posttest design, was used to determine the effects of the *ROAR* antibiotic stewardship program on urgent care providers' antibiotic prescribing for ARIs and assess providers' knowledge and attitude concerning antibiotic use and resistance. A retrospective baseline chart audit of patients with ARIs seen within the urgent care centers was completed to determine the antibiotic prescribing behavior of the healthcare providers which was compared to a prospective post-intervention chart audit. A questionnaire developed by Rodrigues et al. (2016) was used to obtain provider demographic information and assess factors that influence healthcare providers' prescribing behavior.

Validity

To reduce threats to the internal and external validity of the study, specific measures were implemented to preserve the integrity of the data and degree of application to other settings. Aspects to promote internal validity included (a) time duration of two months between the intervention and obtaining post intervention chart data to diminish history and maturation variables, (b) the intervention was administered by the student investigator to diminish implementation variables, (c) a standardized case report spreadsheet to obtain information from EMR and a validated and reliable provider questionnaire to diminish instrumentation variables, (d) participants were not recruited by the medical director to decrease coercion bias, and (e) live seminar participants were provided continuing education units and all participants were provided a \$25 gift card following the intervention to diminish attrition. Aspects to promote external validity involved improving population validity by using study participants who were providers in outpatient facilities treating patients with common illnesses (ARIs) and lessening reactive arrangements by performing the study in a real-life setting.

Outcome Measures

The primary outcome measure of the DNP project was provider antibiotic prescribing rates for ARIs at baseline and post-intervention. Secondary outcomes included differences in ARI antibiotic prescribing between MD and NP providers at baseline and post-intervention, and provider attitude and knowledge regarding antibiotic prescribing and resistance.

Measurement Instruments

Chart reviews. A case report spreadsheet was utilized to collect data from EMR for encounters with the identified International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10) codes (WHO, 2016) for ARIs (see Appendix R1). To ensure accuracy of the data entered, double data entry method was used and data was cleaned to identify and correct

errors made during data entry. Data obtained from medical records was like that of other studies (Gerber et al., 2013; Grover et al., 2013; Linder et al., 2010) to provide content validity. Patients and providers were assigned a code and the code sheet was kept independent of the spreadsheet (see Appendix S). Patient-level data included age, sex, past medical history and antibiotic allergies. Visit-level data included date of service, practice site, clinician, clinician type (MD, NP), duration of illness, ICD-10 codes associated with encounter, diagnostic testing with results, and antibiotic prescriptions generated during encounter. This data was used to determine baseline and post-intervention antibiotic prescribing rates and assess differences of antibiotic prescribing between provider types. Pre- and post-intervention chart audit inclusion criteria consisted of patient encounters with at least one acute respiratory diagnosis on patients of all ages without prior visit to the center or other facilities for ARI during the previous 30 days. Exclusion criteria included encounters in which patients were provided delayed antibiotic prescription or other diagnosis which required antibiotic treatment. ICD-10 codes were used to identify visit diagnoses (see Appendix R2 for study inclusion, Appendix R3 for exclusion). Systematic random sampling was performed utilizing the monthly patient log arranged by date and time of service. From the log, the investigator selected and reviewed the first chart meeting study criteria from each day. If no chart on a specific day met criteria, then the investigator proceeded to the next day. At the end of the month, if there was a low number of charts meeting criteria, then the second chart meeting criteria from each day of the month was included in the data collection.

KAP Survey. Rodrigues et al. (2016) developed a questionnaire on healthcare provider's attitude towards and knowledge of antibiotic prescribing and resistance to assess factors that influence antibiotic prescribing behavior in primary and hospital care providers (see Appendix

T). The survey is a new instrument with limited use in studies. Development of the tool consisted of a literature review to determine concepts of interest; pre-testing of the questionnaire to provide content validity; and evaluation by MDs, psychology and language experts to provide face validation. Reliability was assessed by test-retest method, Cronbach's alpha ($\alpha > 0.70$) for internal consistency and interclass correlation coefficient ($ICC > 0.4$). The self-administered, 26-item questionnaire was designed to be effortlessly completed within five to ten minutes and was distributed to the participants via an emailed link to an online secure database. Permission to use the questionnaire is not required because it is considered open access allowing unrestricted use under terms of the Creative Commons Attribution 4.0 International License. A spreadsheet was used to collect provider demographic information consisting of age, gender, specialty (MD, NP), years of practice, years working in urgent care, number of patients seen per day, and average time spent with patients (see Appendix U).

Quality of Data

Power analysis was performed and determined that 150 patient charts are necessary to detect a significant change in antibiotic prescriptions written for ARIs. Following Regev-Yochay et al. (2011), the student investigator used a medium effect (a 10% reduction in antibiotic prescribing rates), .05 alpha, and .8 power to determine an estimate of sample size. Baseline and post-intervention data was used to determine change in provider antibiotic prescribing rates for ARIs and was compared to other studies (Grover et al., 2013; Vinnard et al., 2013). Rodrigues et al.'s (2016) survey tool uses a visual analogue scale, and results were compared to the studies using questionnaires with Likert-style responses (Abbo et al., 2011, 2012; McCullough et al., 2015).

Analysis

Pre- and post-intervention antibiotic prescribing rates were based on proportion of visits for ARIs with a prescription for antibiotic which was calculated by dividing the number of ARI encounters in which an antibiotic was prescribed by the total number of ARIs. Wilcoxon sign-rank tests and McNemar tests were performed to detect differences between baseline and post-intervention antibiotic prescribing rates for ARIs and to determine differences between MD and NP antibiotic prescribing rates for ARIs. Chi-square tests for association were performed to determine association between type of provider and an antibiotic prescription for ARIs.

Rodrigues et al.'s (2016) questionnaire was used to assess provider knowledge and attitude regarding antibiotic use and resistance. The survey included 17 statements assessing fear, complacency (perception of patient expectations), ignorance (lack of knowledge), indifference (not feeling one way or another) and responsibility of others; and nine statements evaluating useful sources of knowledge. Three statements evaluating beliefs were added by the investigator. Each response was measured with an unnumbered horizontal visual analogue scale scored from full disagreement (0%) to full agreement (100%). Scores were recorded as a number from zero to 100, lower scores indicated greater disagreement and higher scores indicated greater agreement with the statement. Mann-Whitney U tests were performed to determine differences in attitudes regarding antibiotic resistance and use between NPs and MDs, factors that influence antibiotic prescribing, and the most and least important sources of knowledge. Exact *p* values and an alpha level of .05 were used for all statistical tests, and analysis was performed using IBM SPSS Statistics, version 24.0 (IBM Corp, 2016).

Results

Setting and Participants

The DNP project site was eight hospital-owned urgent care centers serving a large metropolitan area of Missouri during cold and flu season, October 2015 to December 2016. Provider demographic data was obtained from the internet-based questionnaire that was available for seven weeks between September to October 2016. All the 59 NP and MD providers employed in the hospital-owned urgent care centers were invited to the study. A total of 12 providers consented to the study, and 8 (67%) completed both the educational session and the pre-questionnaire. Study providers included 5 NPs (62.5%) and 3 MDs (37.5%) with an average of 11.25 years practicing (NP = 2.4 years, MD = 23.33 years) and 4.25 years practicing within an urgent care setting (NP = 2.4 years, MD = 7.33 years; see Appendix V).

Intervention Course, Actual

Pre-intervention groundwork included a 3-month baseline period of patient chart reviews from October to December 2015 that was conducted from August to September 2016. A total of 150 patient charts with ARI visits were reviewed pre-intervention with 60% seen by NPs and 40% seen by MDs which included 28.7% male and 71.3% females, median age of 37.19 years (age range: 3 months - 89 years), and an average duration of illness of 5.48 days. The top three diagnoses included pharyngitis (34.67%), URI (31.33%), and bronchitis (28%). The intervention and post data collection spanned from end-September to December 2016. A one hour clinician education session was delivered by the principal investigator on-site September 20 and 29, 2016 and a video presentation was available on YouTube from mid-September to end-October 2016. Post-intervention patient chart reviews of November and December 2016 were conducted from mid-December 2016 to beginning January 2017. A total of 156 patient charts with ARI visits were reviewed post-intervention with 64.1% seen by NPs and 35.9% seen by MDs which included 40.4% males and 59.6% females, median age of 38.5 years (age range: 1-86 years), and

an average duration of illness of 5.23 days. The top three diagnoses included URI (45.52%), pharyngitis (26.28%), and bronchitis (24.36%; see Appendix W).

Outcome of Antibiotic Prescribing Rates Pre- and Post-Intervention

Overall antibiotic prescribing rates. Of the eight study participants, the intervention elicited an improvement in antibiotic prescribing rate in five participants, whereas three participants saw no improvement (see Appendix X). A Wilcoxon signed-rank test determined post-intervention antibiotic prescribing rates are equivalent to pre-intervention antibiotic prescribing rates, $z = -1.890$, $p = .059$. An exact McNemar's test determined the proportion of antibiotic prescribed decreased from pre-intervention value of 30% to 20% post-intervention, $p = .078$ (see Appendix Y).

Outcome ARI Antibiotic Prescribing Rates Between NP and MD

Pre-intervention type of provider. A Chi-square test for association was conducted between type of provider (NP, MD) and antibiotic prescribed. There was a statistically significant association between type of provider and antibiotic prescription for acute respiratory infection, $\chi^2(1) = 10.714$, $p = .001$. There was a weak positive association between type of provider and antibiotic prescription, $\phi = .267$, $p = .001$. The odds ratio of preferring not prescribing antibiotic in NP vs. MD was 3.273 (95% CI, 1.585 to 6.756).

Post-intervention type of provider. A Chi-square test for association was conducted between type of provider (NP, MD) and antibiotic prescribed. There was a statistically significant association between type of provider and antibiotic prescription for acute respiratory infection, $\chi^2(1) = 12.150$, $p = < .0005$. There was a weak positive association between type of provider and antibiotic prescription, $\phi = .279$, $p = < .0005$. The odds ratio of preferring not prescribing antibiotic in NP vs. MD was 4.155 (95% CI, 1.801 to 9.583).

NP pre- and post-intervention. A Wilcoxon signed-rank test determined post-intervention antibiotic prescribing rates were equivalent to pre-intervention antibiotic prescribing rates, $z = -1.460$, $p = .144$. An exact McNemar's test was run and determined the proportion of antibiotic prescribed decreased from pre-intervention value of 20% to 12% post-intervention, $p = .210$ (see Appendix Y).

MD pre- and post-intervention. A Wilcoxon signed-rank test determined post-intervention antibiotic prescribing rates were equivalent to pre-intervention antibiotic prescribing rates, $z = -1.177$, $p = .239$. An exact McNemar's test was run and determined the proportion of antibiotic prescribed decreased from pre-intervention value of 45% to 34% post-intervention, $p = .327$ (see Appendix Y).

Outcome of Provider Questionnaire

Attitudes. Mann Whitney U tests were run to determine if there were differences in attitudes regarding antibiotic resistance and use between NPs and MDs. Antibiotic resistance was believed to be a problem in their setting by 92.25% of all providers (89.6% NP, 96.67% MD), and the median attitude was not statistically significantly different between NPs (Mdn = 98.00) and MDs (Mdn = 100.00), $U = 5.50$, $z = -.640$, $p = .571$. Antibiotic resistance was believed to be a problem nationally by 96.38% of all providers (98% NP, 93.67% MD), and the median attitude was not statistically significantly different between NPs (Mdn = 98.00) and MDs (Mdn = 100.00), $U = 6.00$, $z = -.458$, $p = .786$. Antibiotics were believed to be overused in their setting by 84.43% of all providers (83.4% NP, 86.67% MD), and the median attitude was not statistically significantly different between NPs (Mdn = 89.00) and MDs (Mdn = 85.00), $U = 7.50$, $z = .000$, $p = 1.0$. Antibiotics were believed to be overused nationally by 89.63% of all providers (90.4% NP, 88.33% MD), and the median attitude was not statistically significantly

different between NPs (Mdn = 99.00) and MDs (Mdn = 85.00), $U = 6.50$, $z = -.302$, $p = .786$ (see Appendix Z).

Factors influencing prescribing. Mann Whitney U tests were run to determine factors that influenced antibiotic prescribing. The most indifference attitude was prescribing an antibiotic even when known that not indicated but no time to explain the reason to the patient (Mdn = 21.50), $U = .000$, $z = -2.236$, $p = .036$. The greatest fear was due to inability to conduct patient follow up (Mdn = 51.00), $U = 3.0$, $z = -1.342$, $p = .250$. The greatest complacency issue was providing an antibiotic to maintain patient trust (Mdn = 25.00), $U = 5.0$, $z = -.745$, $p = .571$. The highest lack of knowledge was thinking there is a need to wait for microbiology results before treating an infectious disease (Mdn = 49.50), $U = 4.0$, $z = -1.043$, $p = .393$. Providers felt it is the responsibility of others to closely control dispensing antibiotics without a prescription (Mdn = 96.00), $U = 7.0$, $z = -.153$, $p = 1.0$ (see Appendix Z).

Sources of knowledge. Mann Whitney U tests were run to determine the most important source of knowledge as CEUs (Mdn = 85.00), $U = 7.0$, $z = -.150$, $p = 1.0$ and least important source as the internet (Mdn = 50.00), $U = 5.0$, $z = -.750$, $p = .571$ (see Appendix Z).

Discussion

Successes, Most Important

The main goal of the study, which was to decrease healthcare providers prescribing antibiotics for ARIs, was achieved within several different aspects: prescribing rate and percentage of antibiotics associated with different diagnoses. Although not statistically significant, there was an overall decrease in antibiotic prescribing for ARIs by all providers from 30% baseline (20% NP, 45% MD) to 20% post-intervention (11% NP, 33.93% MD), which equates to a 33.3% relative reduction and a 10% absolute reduction (NP = 45% relative

reduction, 9% absolute reduction; MD = 24.6% relative reduction, 11.07% absolute reduction). Of the eight providers, three (2 NP, 1MD) did not write for any antibiotics post-intervention. The number of different antibiotics prescribed decreased post-intervention: Amoxicillin decreased 70.47%; Augmentin decreased 68%; and Keflex, Ceftin, Penicillin and Avelox decreased to 0% representing a 100% decrease. The percentage of antibiotics prescribed for diagnoses also decreased post-intervention, antibiotics for bronchitis decreased 4.48%, pharyngitis decreased 72.04%, and URI decreased 56.67% (see Appendix W).

Study Strengths

This study had several strengths. Within the study, the survey was anonymous to reduce socially desirable response and was also web-based to allow greater accessibility. It was a challenge in obtaining study participants at onset and IRB agreed to amend the study allowing the educational seminar intervention to be done by video on-line or live sessions. Within the setting, charts were available via EMR allowing accessibility, a randomized process of obtaining charts to review was utilized to limit sample bias, and the study gathered provider and patient data from an expansive geographical area within a large metropolitan area of Missouri.

Results Compared to Evidence in the Literature

There are numerous studies with various designs targeted at decreasing outpatient antibiotic prescribing for ARIs. Studies which utilized academic detailing interventions similar to this study reported decrease in antibiotic prescribing rate from 69% to 56% (19% relative reduction, 13% absolute reduction, Grover et al, 2013) and from 43% to 33% (23.26% relative reduction, 10% absolute reduction, Vinnard et al, 2013). This current study revealed an overall decrease in antibiotic prescribing for ARIs by all providers from 30% baseline to 20% post-intervention which equates to a 33.3% relative reduction and a 10% absolute reduction.

Within the literature review, no studies were found that compared the antibiotic prescribing rates between different providers (NP vs. MD). This study did reveal that NPs decreased antibiotic prescribing rate from 20% to 11% (36% relative reduction, 9% absolute reduction) and MDs decreased antibiotic prescribing rate from 45% to 33.93% (24.6% relative reduction, 11.07% absolute reduction). There was a weak positive association between type of provider and antibiotic prescription pre- and post-intervention in which the odds ratio of NPs preferring not to prescribe an antibiotic was 3.273 (pre-intervention) and 4.155 (post-intervention) times more than MDs.

A 2015 systematic review included 57 studies of 11,593 clinicians' perceptions about antibiotic use and resistance, and the study revealed that 92% believe antibiotic resistance is a problem nationally whereas 77% believe it to be a problem locally (McCullough et al., 2015). In contrast, 96.38% of the providers in this study believe antibiotic resistance to be a problem nationally and 92.25% believe it to be a problem locally. In previous studies, MDs believe antibiotics are overused locally 76% and nationally 94% (Abbo, et al., 2011), and NPs believe antibiotics are overused locally 54% and nationally 93% (Abbo et al., 2012) which contrasts to this study findings that MDs believe antibiotics are overused locally 86.67% and nationally 88.33% and NPs believe antibiotics are overused locally 83.4% and nationally 90.4%.

Limitations

Internal validity effects. This study had several limiting factors. First, with the data obtained, the investigator is not able to determine which element(s), educational seminar or audit and feedback or email reminders, decreased antibiotic prescribing. Second, regarding instrumentation, it is unknown if those providers who chose to view the video presentation watched it completely, and although the KAP questionnaire was validated, it was developed in

2016 and had not reportedly been used by other studies. Third, a few of the study providers were already low antibiotic prescribers at baseline. Fourth, the KAP questionnaire responses and prescribing behavior can be influenced because the provider knowingly is participating in a study (Hawthorne effect). Fifth, participant selection bias might have occurred via personal recruitment by the principal investigator.

External validity effects. There were several factors that can affect generalizability. First, generalizability of results can be negatively affected by the small number of study participants and charts reviewed. Second, the intervention was implemented within a hospital-owned system of urgent care centers, excluding the hospital emergency department and primary care providers associated with the network. Third, the study's limited length of observation period following the intervention, November to December 2016, is not a substantial duration of time to measure sustainability of decreased antibiotic prescribing.

Sustainability of effects and plans to maintain effects. Sustainability of the DNP project can be a challenge because of providers' reluctance to change their prescribing behaviors. Nevertheless, antibiotic stewardship sustainability will require support from management and administrators, implementing the program into new provider orientation, and adding it to the policies and procedures guidelines. Key facilitators should perform annual chart audit and individualized provider feedback of antibiotic prescribing to give insight on their performance in accordance with local and national antibiotic prescribing rates. Once reminders or education are stopped, one would expect the antibiotic prescribing rates to slowly increase overtime. Therefore, to maintain low prescribing rates, quarterly reminders with yearly classes are recommended to stress the importance of antibiotic stewardship.

Efforts to minimize the study limitations. The study was purposefully conducted at the end of the year to obtain data during cold/flu season because studies have shown increase in antibiotic prescribing during winter months (Suda, Hicks, Roberts, Hunkler & Taylor, 2014). To increase the number of study participants, recruitment was done via email, personal visits to centers, and during one provider meeting. Although personal recruitment could have added to selection bias, it was determined that the medical director would not encourage participation to decrease coercion bias. Also, the decision was made to perform two live educational sessions in addition to video presentation and offering continuing medical education credit to those who attended the live session to increase study participation. Finally, the KAP questionnaire was web-based to provide easy access for participants and done prior to education sessions to elicit genuine attitudes regarding antibiotic resistance and use.

Interpretation

Expected and actual outcomes. From this study, there was an expectation of all providers to decrease antibiotic prescribing rates, especially in those who had a higher baseline prescribing rate, and to obtain statistically significant results. Unfortunately, this was not the case and might be due to reluctance of the providers to change prescribing behavior, the investigator not providing clinician-specific prescribing rate feedback, and the low number of study participants and charts reviewed. Unexpectedly, there were a few providers who had a low baseline antibiotic prescribing rate that increased post-intervention. This could be possibly attributed to patients diagnosed with conditions in which there is a higher antibiotic prescribing rate such as bronchitis or provider uncertainty with cause of illness being viral in nature. However, three providers successfully decreased their antibiotic prescribing rate to 0% post-intervention.

Intervention's effectiveness. The study's multifaceted intervention was designed to include concepts of prior successful academic detailing studies focused on decreasing outpatient antibiotic prescribing and to target and affect provider beliefs which is essential in changing prescribing behavior. Rather than the intervention performed by a team of people who have different personalities and teaching styles, the intervention was performed by the principal investigator, a colleague to study participants. Because of the feedback obtained and interaction among the principal investigator and participants, it is most likely that small group settings of up to 20 outpatient, emergency department or urgent care providers would be effective in generating dialogue and affecting antibiotic prescribing practices.

Intervention revision. There are a few modifications that can achieve greater effects. First, the KAP questionnaire should be distributed months prior to the intervention to determine factors that influence antibiotic prescribing and focus education based on those findings. Second, because the intervention is multifaceted, additional elements such as addressing patient education through education posters and brochures in waiting and exam rooms, and providing clinician specific along with system wide antibiotic prescribing rates feedback to each provider may enhance improvement in appropriate prescribing. And last, the charting is done via EMR, and a program can be installed to provide pop-up reminders and alerts when choosing antibiotic treatment with associated diagnoses.

Expected and actual impact to health system, costs, and policy. This EBP intervention can impact healthcare providers' knowledge regarding antibiotic resistance and use while decreasing antibiotic prescribing habits for those patients presenting with ARIs. The intervention will also bring antibiotic stewardship to the forefront of quality healthcare allowing increased health benefits through preserving antibiotic effectiveness, decreasing antibiotic

resistant infections, and reducing healthcare costs associated with this global public health problem. Antibiotic stewardship programs were initially started in hospital settings; however, studies have revealed in the United States among the many outpatient prescription medications that few are more widely prescribed than antibiotics (Gerber et al., 2013; Lee et al., 2014).

Utilizing the study intervention in urgent care centers, emergency departments, and primary care offices will effectively expand antibiotic stewardship to the ambulatory setting to comply with the *National Action Plan for Combating Antibiotic-Resistant Bacteria* in reducing outpatient inappropriate antibiotic use by 50% by 2020 (The White House, 2015).

Over the course of the intervention, costs changed in which the cost of investigator and CME accreditation were removed, CDC brochures were obtained free of charge, the number of provider gift cards was reduced, items that needed to be printed was increased although it was \$205 less than projected printing cost, catered food to educational sessions remained the same, and costs for USB card and dissemination of the project at the Advanced Practice Nurses of Ozarks conference was added. Grant funding was not obtained; therefore, every effort was used to limit costs. Total direct and indirect costs incurred totaled \$1128, which was \$899 less than the projected budget of \$2027. Economic sustainability can be achieved with this simple, low-cost intervention over numerous years by removing monetary incentives and replacing with continuing educational credits, integrating the program into provider orientation, emailing quarterly reminders, and hosting yearly classes within the hospital system.

Conclusion

Practical Usefulness of Intervention

Interventions that are patient-centered; easily implemented into practice; and allow healthcare providers to reflect on practice, decrease doubt about treatment, and learn appropriate

prescribing will foster change in antibiotic prescribing behavior (Tonkin-Crine, Yardley, & Little, 2011). Healthcare providers must adhere to antibiotic prescribing measures to preserve antibiotic effectiveness and decrease antibiotic resistance, and educating healthcare providers is a major step in changing antibiotic practices. The development and utilization of an outpatient antibiotic stewardship program will promote judicious use of antibiotics for ARIs by healthcare providers within urgent care, emergency department, and primary care facilities.

Further Study of Intervention and Dissemination

Implementing the antibiotic stewardship intervention within the hospital system fosters continual measurement of the rate of antibiotic prescription incidence associated with ARIs and potentially determines broad-spectrum antibiotic rates for ARIs and patient return visit (≤ 30 days from incident visit) rates. The ROAR DNP project proposal was presented to other advanced practice nurses via poster presentation November 11, 2016 at the Advanced Practice Nurses of the Ozarks conference in Branson, Missouri. A poster of the completed ROAR DNP study was presented at the University of Missouri – Kansas City’s Health Sciences Student Research Summit April 26, 2017. Both poster presentations allowed sharing of antibiotic stewardship principles with other providers, professors, and students and align with national and local efforts to improve antibiotic use within outpatient and hospital settings. An executive summary was written and distributed to the study participants, urgent care management, hospital administration, and IRB. A manuscript was written and submitted to the *Journal of Doctoral Nursing Practice* to foster healthcare provider knowledge on antibiotic stewardship.

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Appendix A1

Definition of Terms

Academic detailing interventions provide detailed clinician education (CDC, 2015c).

Antibiotic resistance is a phenomenon that happens when an antibiotic loses its ability to successfully eradicate bacterial growth (Institute of Medicine [IOM], 2010).

Antibiotic stewardship is an interventional program for healthcare providers to enhance knowledge of antibiotic resistance and promote principles of responsible antibiotic use to preserve antibiotic effectiveness and decrease resistance (CDC, 2013; Gangat & Hsu, 2015).

Communication skills interventions are geared towards improving healthcare providers' communication with patients informing them about their clinical condition and non-use of antibiotics for self-limiting conditions (Llor & Bjerrum, 2014).

Computer decision support system interventions embed algorithms within the electronic health record allowing clinicians to review treatment strategies (CDC, 2015b).

Feedback interventions use feedback to allow the healthcare provider to view a summary of their antibiotic prescribing rates over a specified period (CDC, 2015d).

Guidelines interventions include provision of evidence-based guidelines to healthcare providers to assist in clinical treatment.

Knowledge, Attitude and Perception (KAP) surveys are focused evaluations that analyze the extent of awareness about, beliefs towards, and practice in relation to health-related concepts (Launiala, 2009) uncovering misconceptions and potential barriers to devise interventions based on knowledge gaps, misguided beliefs and erroneous attitudes (Launiala, 2009; SPRING, 2014; Unite for Sight, 2010).

Appendix A2

Synthesis of Evidence Table

First Author, (Year), Title, Journal	Purpose & Study Timeframe	Research Design ¹ , Evidence Level (1-7) ² , Variables ³	Setting, Sample ^{4a} (size), Sample Type, & Place	Measures, Reliability (if reported) & Results	Strengths, Limitations & Usefulness
Knowledge, Attitude, and Practices Among Healthcare Providers Regarding Antibiotic Use and Stewardship					
Abbo (2011). Faculty and resident physicians' attitudes, perceptions, and knowledge about antimicrobial use and resistance. <i>Infection Control and Hospital Epidemiology</i>	Assess attitudes, perceptions, & knowledge about ABX use & resistance. Aug 3 to Sept 14, 2009	Quantitative, descriptive study (survey) Level 6	Teaching Hospital 609 clinicians (MD: 329, Resident: 280) Voluntary, anonymous Florida, USA	Influential factors affecting ABX prescribing: missing infection ($p = .001$), critically ill or immune-compromised patient ($p < .001$). Highly aware of ABX resistance & concerned. ABX overused nationally (94%) & locally (76%), inappropriate use causes resistance (97%) 13% believed they themselves (62% others) overprescribe ABX. ABX knowledge test mean score 67%.	<u>Strengths:</u> Anonymous <u>Limitations:</u> 50.75% response rate, questionnaire not externally validated, single institution, selection bias, surveys may be gaps between what is said/done. MDs only. <u>Usefulness:</u> Demonstrates areas to target w/ interventions.
Abbo (2012). Nurse Practitioners' attitude, perceptions, and knowledge about antimicrobial stewardship. <i>The</i>	Assess attitudes, perceptions, & knowledge about ABX use, resistance, & stewardship.	Quantitative, descriptive study (survey) Level 6	Teaching Hospital 58 Nurse Practitioners Voluntary, anonymous	Influential factors affecting ABX prescribing: missing infection (67%) or critically ill or immune-compromised patient (89%) often/always affect decision to select ABX. Highly aware of ABX resistance & concerned. 60% start with broad-spectrum ABX. ABX overused nationally (93%), locally (54%), inappropriate use causes resistance (98%)	<u>Strengths:</u> Anonymous, assessed NPs <u>Limitations:</u> Low response rate (43%), small study, selection bias, questionnaire not externally validated,

<p><i>Journal for Nurse Practitioners</i></p>	<p>Aug 23 to Nov 4, 2009</p>		<p>Florida, USA</p>	<p>4% believed they themselves (6% others) overprescribe ABX. 66% not familiar with ABX stewardship & only 17% perceived as useful. ABX knowledge test mean score 69%.</p>	<p>single institution, surveys may be gaps between what is said/done. <u>Usefulness:</u> Demonstrates areas to target w/ interventions.</p>
<p>Sanchez (2014). Effects of knowledge, attitudes, and practices of primary care providers on antibiotic selection, United States. <i>Emerging Infectious Diseases</i></p>	<p>Explore knowledge, attitudes, & self-reported practices regarding ABX therapy & assess factor influencing ABX choice May 2013</p>	<p>Quantitative, descriptive study (open-ended phone interview) Level 6</p>	<p>Primary care 36 providers (MD: 27, NP: 5, PA: 4) Purposive sampling with certain exclusion criteria USA</p>	<p>Common perceptions for inappropriate ABX prescribing: patient pressure (perceive they expect ABX), fear of complications, patient satisfaction, & decrease in visit length. Aware of guidelines yet not always comply, believe broad-spectrum ABX better cure rate. Believe changing behavior is difficult & reluctant to change because been doing that way for years.</p>	<p><u>Strengths:</u> Open-ended interview <u>Limitations:</u> Small study sample, not generalizable because lack of external validity, selection bias, with surveys may be considerable gaps between what is said and what is done <u>Usefulness:</u> Demonstrates areas to target w/ interventions.</p>

First Author, (Year), Title, <i>Journal</i>	Purpose & Search Timeframe	Research Design ¹ , Evidence Level (1-7) ² , Database	Number of Studies & Place	Setting, Sample ^{4a} (size), & Sample Type	Analysis Used & Results	Strengths, Limitations & Usefulness
Systematic Review: Knowledge, Attitude, and Practices Among Healthcare Providers Regarding Antibiotic Use and Stewardship						
McCullough (2015). Not in my backyard: a systematic review of clinicians' knowledge and beliefs about antibiotic resistance. <i>Journal of Antimicrobial Chemotherapy</i>	Review knowledge & beliefs about significance & causes of ABX resistance & plans to reduce. Inception until 3 rd week July 2014	Systematic review quantitative, qualitative & mixed method studies Level 5 Searched MEDLINE, EMBASE, PsycINFO, CINAHL	57 studies Quant: 38 Qual: 14 Mix: 5 N. America (39%), Europe (26%), Asia (19%), S. America, Africa, Australia (each 5%)	Hospital, primary care, university, mixed 11,593 clinicians: MD (63%), nurses (4%), pharmacists (5%), dentists (5%), mixed (23%) Sampling: Convenience, purposive, random, snowball, not reported	Median, IQR & range calculated for % of participants agreeing with each category. Quant data synthesis: ABX resistance problem globally (89%), nationally (92%), locally (77%), & in their practice (67%). Causes of resistance: inappropriate use (94%), broad-spectrum use (95%), patient non-adherence to ABX (90%). (69%) heard of ABX resistance To reduce resistance, need to decrease ABX use (96%) & need educational interventions (90%). Qual data synthesis: some don't believe ABX resistance serious problem or believed out of their control; ABX resistance lower priority than immediate patient needs.	<u>Strengths:</u> Comprehensive search, qualitative data allowed understanding of findings. <u>Limitations:</u> diverse quantitative outcomes & various study sizes, low to moderate response rates, question validity not known, possible response bias (answer in way viewed favorable). <u>Usefulness:</u> Demonstrates areas where interventions could be targeted.

First Author, (Year), Title, <i>Journal</i>	Purpose & Search Timeframe	Research Design ¹ , Evidence Level (1-7) ² , Database	Number of Studies & Place	Clinical Condition ⁵ , Provider ⁶ Surveyed	Measures, Analysis Used (if reported), & Results	Strengths, Limitations & Usefulness
Systematic Reviews: Understanding Healthcare Provider Antibiotic Prescribing Behavior						
Lopez-Vazquez (2011). Misprescription of antibiotics in primary care: A critical systematic review of its determinants. <i>Journal of Evaluation in Clinical Practice</i>	Identify factors, attitudes, & knowledge related to ABX over prescribing. Jan 1987 to Feb 2008	Systematic review qualitative studies Level 5 Searched MEDLINE-PubMED, EMBASE, other references cited	46 papers USA: 16, UK: 4, Netherlands: 4, Australia: 3, & 16 other countries	39 studies: respiratory infections 7 studies: no condition or other MD only	Factors associated with ABX prescribing: Socio-demographic & personal not much influence. MD attitude – perceived patient expectation & fear of complications. Patient characteristics – 1 or more pt sign/symptoms, # patients seen daily. Socio-demographic & personal factors exhibited not much influence. Complacency (perceived patient expectations), fear (possible patient complications), one or more patient signs/symptoms, number of patients seen daily - associated with ABX prescribing.	<u>Strengths:</u> Reviewed multiple studies. <u>Limitations:</u> Evaluated MD views only. <u>Usefulness:</u> Guidance in determining key concepts to focus on when developing interventions.
Rodrigues (2013). Understanding physician antibiotic	Explore physicians' perceptions of factors	Systematic review qualitative studies	35 papers Qualitative: 26 Mixed: 9	12 studies: respiratory infections	Factors associated with ABX prescribing: Most influential on ABX prescribing was complacency	<u>Strengths:</u> Looked at MD & other providers. <u>Limitations:</u> Small numbers of

<p>prescribing behaviour: A systematic review of qualitative studies. <i>International Journal of Antimicrobial Agents</i></p>	<p>influencing ABX prescribing. Jan 1987 to Dec 2011</p>	<p>Level 5 Searched MEDLINE, PubMed</p>	<p>5 different continents, mainly Europe (18) & USA (10)</p>	<p>15 studies: didn't id conditions 8 studies: other conditions MD, nurses, other healthcare providers</p>	<p>or fear. Extrinsic factors - patient sign/symptom & time pressures or guidelines implemented. Indirect factors- communication skills & diagnostic uncertainty.</p>	<p>participants, included only heterogeneous studies making susceptible to bias. <u>Usefulness:</u> determine key concepts to focus on when developing interventions.</p>
<p>Rezal (2015). Physicians' knowledge, perceptions and behaviour towards antibiotic prescribing: A systematic review of the literature. <i>Expert Review of Anti-infective Therapy</i></p>	<p>Review knowledge, perceptions, & prescribing behavior regarding ABX prescribing. 1990 to 2014</p>	<p>Systematic review qualitative studies Level 5 Searched Scopus, PubMed, ISI Web of Knowledge, Proquest, ScienceDirect, Google Scholar, & bibliographies of retrieved studies</p>	<p>19 articles 11 developed countries (USA: 4), 8 developing countries</p>	<p>Majority of studies evaluated respiratory conditions MD only</p>	<p>MDs still with inadequate knowledge & misconceptions. Underestimate ABX resistance. Factors associated with increased ABX prescribing: patient expectations, acuity & duration of illness, uncertainty of diagnosis, potential of losing patients.</p>	<p><u>Strengths:</u> Providers from different specialties interested in learning more & improving ABX prescribing, also want feedback on ABX prescribing, studies from developed & developing countries <u>Limitations:</u> results related to MDs only. <u>Usefulness:</u> determine key concepts to focus on when developing interventions.</p>

Institute (Year)	Purpose	Research Design ¹ , Evidence Level (1-7) ²	Clinical Condition ⁵ , (Author) Strengths & Limitations
Evidence-Based Guidelines			
Institute for Clinical Systems Improvement (2013).	Diagnosis and management	Evidence Based Practice Guidelines Level 1	Respiratory illness in children and adult (Snellman, et al): Strep pharyngitis, noninfectious rhinitis, bacterial sinusitis, viral upper-respiratory infection <u>Strengths:</u> Multiple diagnoses, interactive links on algorithms, all ages, patient information. <u>Limitations:</u> Links only active on computer.
American College of Physicians & Centers for Disease Control Prevention (2016).	Diagnosis and management	Evidence Based Practice Guidelines Level 1	Acute respiratory infections in adults (Harris, Hicks & Qaseem): Acute bronchitis, pharyngitis, acute rhinosinusitis, common cold <u>Strengths:</u> Easy to read, multiple diagnoses, care advice, management strategies, determinants of bacterial infection, tips on appropriate ABX use <u>Limitations:</u> Limited patient information, only adults.

First Author, (Year), Title, <i>Journal</i>	Purpose & Search Timeframe	Research Design ¹ , Evidence Level (1-7) ² , Database	Number of Studies, Type of Studies, & Place	Clinical Condition ⁵	Measures, Analysis Used & Results	Strengths, Limitations & Usefulness
Systematic Reviews: Interventions						
Ranji (2008). Interventions to reduce unnecessary antibiotic prescribing: A systematic review and quantitative analysis. <i>Medical Care</i>	Evaluate effect of interventions to reduce unnecessary ABX prescribing. (Jan 1996 to March 2007)	Systematic review quantitative studies Level 1 Searched Cochrane Collaboration Effective Practice & Organization of Care database, MEDLINE, & bibliographies of included articles	43 studies reporting 55 separate trials 24 randomized control trials, 26 controlled before-after trials, 5 quasi-randomized control trials Most studies conducted in USA & Europe but also included 15 other countries	38 studies: ARIs 8 studies: didn't id disease 4 studies: acute diarrhea	Calculated median effect size of studies then used nonparametric statistics to compare trials with & without characteristics of interest. 30 eligible trials, median reduction in ABX use was 9.7% (interquartile range 6.6-13.7%), equal to relative reduction of 25%. No individual or combo of interventions significantly more effective than other ($p=0.85$). Active education more effective than passive education ($p=0.096$). Savings at population level ranging from 17 to 117 prescriptions per 1000 person-years.	<u>Strengths:</u> All studies outpatient & majority involved ARIs. Evaluated fair amount of studies. 54% of studies able to perform quantitative analysis on synthesized data. <u>Limitations:</u> No formal meta-analysis since many did not report exact numbers. Small # trials each group = lack of statistical power to evaluate effectiveness of intervention. Effects of interventions may not be generalizable. <u>Usefulness:</u> Active clinician education interventions are effective at reducing ABX use.

<p>van der Velden (2012). Effectiveness of physician-targeted interventions to improve antibiotic use for respiratory tract infections. <i>British Journal of General Practice</i></p>	<p>Assess effectiveness of clinician-targeted interventions to improve ABX prescribing for ARTIs in primary care and identify successful features.</p> <p>(Jan 1990 to July 2009)</p>	<p>Systematic review quantitative studies Level 1</p> <p>Searched MEDLINE, EMBASE, & Cochrane Library</p>	<p>58 studies describing 87 interventions</p> <p>41% were controlled before after design, 29% RCT, remaining RCTs without baseline measurement or interrupted time series-like design</p>	<p>All studies addressed ARIs</p>	<p>Association between effectiveness & intervention features analyzed in logistic regression.</p> <p>87 Interventions: educational material for provider, educational meeting, audit & feedback.</p> <p>60% (52) of interventions significantly improved ABX prescribing, overall ABX prescription reduced by 11.6%. Multiple interventions with educational material for provider effective (adjusted OR 6.5; 95% CI 1.9-22).</p>	<p><u>Strengths:</u> Studies outpatient & involved ARIs. Evaluated fair amount of studies.</p> <p><u>Limitations:</u> Broad variety of designs decreases overall quality, differences in outcome measures cannot be compared.</p> <p><u>Usefulness:</u> Multifaceted interventions with provider education, communication training, & lab testing effective in reducing ABX prescribing.</p>
<p>Drekonja (2015). Antimicrobial stewardship in outpatient settings: A systematic review. <i>Infection Control and Hospital Epidemiology</i></p>	<p>Evaluate effect of outpatient ABX stewardship programs.</p> <p>(Jan 2000 to Nov 2013)</p>	<p>Systematic review quantitative studies Level 1</p> <p>Searched MEDLINE, EMBASE, & Cochrane Library</p>	<p>50 studies: 17 RCT, 18 cluster RCT, 3 controlled clinical trials, 6 controlled before/after trials, 6 interrupted times series studies</p> <p>Studies conducted in</p>	<p>58% studies reporting on respiratory tract infections</p> <p>34% studies reporting multiple/ unspecified infections</p>	<p>Assessed risk of bias & rated overall strength of evidence for individual studies.</p> <p>9 intervention types with 55 interventions</p> <p>Medium strength evidence: programs with communication skills & lab testing decrease ABX prescribing; low strength evidence (40 of the 55 interventions): other interventions decrease ABX prescribing.</p>	<p><u>Strengths:</u> All studies outpatient & majority involved ARIs, good number studies.</p> <p><u>Limitations:</u> Differences of interventions: difficult to pool results.</p> <p><u>Usefulness:</u> Outpatient ABX stewardship interventions of all types decrease ABX prescribing. Many interventions</p>

			USA, Canada, Europe, UK, Middle East, Asia/Pacific region			multifaceted. Lab testing to help ABX stewardship is a favorable tool & communication showed promising results.
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Drekonja (2015) Detailed results
 Provider &/or patient education intervention (16 studies): most interventions were multifaceted, 6 studies found decreased ABX prescribing & 6 found no difference.
 Provider feedback intervention (5 studies): 3 associated with significant decreases in ABX prescribing.
 Guidelines intervention (6 studies): 3 found significant ABX decreases post-intervention.
 Delayed prescribing intervention (4 studies): 2 found reduction in ABX use in which 1 study provided education component.
 Communication skills training (6 studies): all involved multifaceted interventions, 5 reported significantly reduced ABX prescribing.
 Restriction policies intervention (2 studies): 1 showed decreasing trend in ABX prescriptions.
 Computerized clinical decision support (6 studies): 4 associated with decreased ABX prescribing.
 Financial incentives intervention (1 study): improved volume of prescribing & adherence to guidelines for only 2 of the 7 ABX studied.
 Laboratory testing interventions (9 studies): rapid antigen & C-reactive protein testing were associated with decreased ABX prescribing.

First Author, (Year), Title, Journal	Purpose & Study Timeframe	Research Design ¹ , Evidence Level (1-7) ² , Variables ³	Setting, Sample ^{4b} (size), Sample Type, & Place	Clinical Condition ⁵ , Provider ⁶ (size) & Patient Age ⁷	Measures, Reliability (if reported), Analysis Used, & Results	Strengths, Limitations & Usefulness
Computer Decision Support System Intervention (CDSS)						
Litvin (2012). Use of an electronic health record clinical decision support tool to improve antibiotic prescribing for acute respiratory	Analyze the effect of CDSS on ABX prescribing for ARI in primary care. Jan. 2010 to March 2012	Quantitative, quasi-experimental Level 3 IV: intervention consisting of CDSS as template with	9 primary care practices in a practice-based research network Patients (38,592 for total study time)	Allergic rhinitis, asthma, bronchitis or bronchiolitis, COPD exacerbation, laryngitis or tracheitis, non-	Entire 27-month study course Weighted means and 95% CI determined for outcome measures during 1 st quarter of interventions. General linear mixed models for longitudinal analyses to compare changes	<u>Strengths:</u> Study done over 9 states, sustainable over 27 months, multiple factors affect prescribing of ABX for ARI, positive impact of CDSS to use narrow-spectrum ABX

<p>infections: the ABX-TRIP study. <i>Journal of General Internal Medicine</i></p>		<p>diagnostic pathways, guidelines for ABX prescribing, academic detailing and training, audit & feedback (ABX-TRIP CDDS)</p> <p>DV: % prescribed ABX</p>	<p>Practices volunteered to participate in study</p> <p>9 states (NC, KY, WA, AK, AZ, MS, UT, GA, IL), USA</p>	<p>suppurative otitis media, pharyngitis or tonsillitis, pneumonia, sinusitis, streptococcal pharyngitis, suppurative otitis media, URI</p> <p>MD (27), NP (6), PA (6)</p> <p>C, A</p>	<p>over time. $p < 0.05$ statistically significant</p> <p>ABX use for when ABX are rarely appropriate did not significantly change: estimated 1.57% in adults [95% CI -5.35 to 8.49%] and -1.89% in children [95% CI -9.03 to 5.26%]. Broad-spectrum ABX decreased significantly (16.30% in adults ($p < 0.05$) & 16.30% in children). Broad-spectrum ABX decreased for sinusitis (19.74% $p < 0.05$) & bronchitis (11.71%).</p>	<p><u>Limitations:</u> No control group & no way to affirm changes not due to secular trends, small group of volunteer practices, multifaceted intervention not able to tell which intervention more effective</p> <p><u>Usefulness:</u> multifaceted intervention, sustainable with decreasing broad-spectrum ABX use for ARI, primary care</p>
<p>Mainous (2013). Impact of a clinical decision support system on antibiotic prescribing for acute respiratory infections in primary care: quasi-experimental trial. <i>Journal of the American Medical</i></p>	<p>Assess effect of CDSS integrated into EHR on ABX prescribing for ARIs.</p> <p>Oct. 2009 to March 2011</p>	<p>Quantitative, quasi-experimental Level 3</p> <p>IV: intervention consisting of CDSS as a template with diagnostic criteria to assist diagnosis, antibiotic guidelines,</p>	<p>70 primary care practices</p> <p>9 control practices volunteered. 61 control practices were chosen due to specific site requirements.</p> <p>9 states, USA</p>	<p>Non-specific URI, otitis media with effusion, bronchitis, pharyngitis, COPD exacerbation, otitis media, strep pharyngitis, PNA, sinusitis</p>	<p>Pre- & post-intervention data Compared baseline between groups with independent-sample t tests. Compare changes among groups over time with linear mixed models.</p> <p>In adults, inappropriate ABX prescribing for ARIs decreased 0.6% ($p = 0.03$) in intervention group but increased 4.2% in control group. In peds this was increased in intervention group 1.4% ($p = 0.34$) & control group</p>	<p><u>Strengths:</u> Study adjusted potential confounding variables to increase validity of research design.</p> <p><u>Limitations:</u> Requires computerized EHR. Providers can change diagnosis to justify ABX use. Confounder: study overlapped with 2009 H1N1 flu pandemic. Individual prescribing</p>

<i>Informatics Association (JAMIA)</i>		audit & feedback DV: % prescribed ABX		MD (27), NP (6), PA (6) All ages	4.2%. Broad-spectrum ABX use declined in intervention group with adults (16.6%) & ped (19.7%) (each $p < 0.0001$) compared to increase in control group (1.2% adult, 0.9% ped). Patients with ARI less likely to receive broad-spectrum ABX if template used (adult: 45.9% vs. 56.8% $p < 0.004$, ped: 24.6% vs. 35% $p < 0.0001$). little evidence of diagnostic shift.	data not available. Difficult to determine if CDSS alone would be effective strategy. <u>Usefulness:</u> Modest effect in decreasing inappropriate ABX prescribing in adults, substantial impact on decreasing use of broad-spectrum ABX in all ages.
Rattinger (2012). A sustainable strategy to prevent misuse of antibiotics for acute respiratory infections. <i>Public Library of Science (PLOS) ONE</i>	Determine if CDSS embedded in EHR at time of order entry for selected ABX would adjust ABX utilization toward treatment guidelines for ARIs.	Quantitative, quasi-experimental Level 3 IV: intervention consisting of CDSS tool targeting gatifloxacin and azithromycin DV: % prescribed ABX	2 outpatient clinics Patients (pre 717 / post 3,114) Convenience sample of patients Maryland, USA (intervention site) Salt Lake City, USA (control site)	PNA, bronchitis, sinusitis, nonspecific acute respiratory infection Attending physicians & medical students A, EP (16-97 years) without COPD	Pre- & post- intervention data. Multivariable logistic regression & difference-in-difference regression analyses to estimate effect of CDSS intervention on overall ABX prescribing accordance. The targeted ABX remained most prescribed of the warranted (justified) ABX. Utilizing the CDSS, the proportion of unwarranted use of gatifloxacin & azithromycin decreased from 22% to 3.3% ($p < 0.0001$). Proportion of total ARI where ABX use was in accord with guidelines increased in intervention site	<u>Strengths:</u> Long duration, large sample size, sustainable after 4 yrs. <u>Limitations:</u> Need computer charting, study not randomized, implemented at only one site, may not be generalizable, population mostly male adults, dealt with attempt to reduce prescribing of only 2 ABX <u>Usefulness:</u> embedding CDSS into program can help deter prescribing ABX for

					($p=0.0001$) but unchanged at control site ($p=0.10$).	unwarranted conditions, but need limitations on more broad-spectrum ABX.
Gonzales (2013). A cluster-randomized trial of decision support strategies for reducing antibiotic use for acute bronchitis. <i>JAMA Internal Medicine</i>	Compare the effect of 2 decision support strategies on ABX treatment of uncomplicated acute bronchitis.	Quantitative, RCT Level 2 IV: intervention consisting of printed decision support (PDS) or computerized decision support (CDS), provider education and feedback & patient education DV: % prescribed ABX	33 primary care practices Patients (9,808 / 6,242) 3-arm cluster randomization of implementation strategies to determine study (11 printed or 11 computerized intervention) & 11 control groups (no intervention) Pennsylvania, USA	Acute bronchitis & bronchitis, not otherwise specified MD, NP, PA Ad, A (> 13 & < 64) without comorbidities & ABX responsive secondary diagnoses	Pre- & post-intervention data Used generalized estimating equations & alternating logistic regression. $p<0.05$ statistical significant % of ABX prescribed during intervention period decreased at PDS sites (80% to 68.3%, $p=0.003$) & CDS sites (74% to 60.7%, $p=0.014$), but increased at control sites (72.5% to 74.3%). About 1/3 providers decreased ABX prescription rates by over 20% at PDS & CDS sites. No significant difference in return visits between baseline & intervention periods.	<u>Strengths:</u> Large sample, multiple settings, multifaceted intervention, time frame during winter periods (Oct to March) captured increased occurrences of diagnoses. <u>Limitations:</u> Sites rural /semi-rural practices, short duration of time frame studied, subject to Hawthorne effect, not able to determine which intervention was more effective. <u>Usefulness:</u> Paper & computer evidence-based can reduce ABX prescribing.
Jenkins (2013). Effects of clinical pathways for common outpatient infections on	Determine effects of decision support clinical pathways on	Quantitative, quasi-experimental Level 3	8 outpatient clinics Patients (31,368 / 17,022)	Nonspecific URI, acute bronchitis, acute rhinosinusitis, acute	Pre- & post-intervention data Generalized linear mixed effects model to analyze trends in ABX prescriptions for non-PNA URI & broad-spectrum ABX use. Pearson X^2 test:	<u>Strengths:</u> Large sample, multiple settings, multifaceted intervention, obtained 1-yr post intervention data.

antibiotic prescribing. <i>The American Journal of Medicine</i>	ABX prescribing.	IV: intervention consisting of clinical pathways, patient education, & peer advocate DV: % prescribed ABX	Convenience sample of providers with stratified randomization of clinics to determine 4 study (intervention) & 4 control group (no intervention) Denver, USA	pharyngitis, acute otitis media, UTI, STI, PNA MD (80) C, Ad, A	proportion of ABX prescription. Piecewise logistics regression model assessed pre-post. Study group showed 11% relative reduction (42.7% to 37.9%, $p<0.0001$) ABX use for non-PNA URI & 14% relative reduction (26.4% to 22.6%, $p<0.001$) in use of broad-spectrum ABX. Control group overall change in ABX prescribing not statistically significant, provided ABX 2.8% less frequently (from 39.8% to 38.7%, $p=0.25$) & used broad-spectrum ABX 3% less frequently (from 20.0% to 19.4%, $p=0.35$).	<u>Limitations:</u> Prescribing rates underestimated due to networks used, misclassification electronic data, study subject to Hawthorne effect, adverse event data not available for 4 clinics, unable determine which intervention more effective, unknown sustainability. <u>Usefulness:</u> Generalizable multifaceted intervention can be utilized to decreased ABX prescribing for URIs & use of broad-spectrum ABX at other facilities.
Academic Detailing Intervention						
Regev-Yochay (2011). Reduction in antibiotic use following a cluster randomized controlled multifaceted	Assess whether intervention among physicians and patients attain a continued decrease in antibiotic use.	Quantitative, cluster RCT Level 2 IV: intervention consisting of focus group meetings, workshops,	Primary care pediatric solo practices MDs placed in control or intervention group by	URI, fever, otitis media, pharyngitis, common cold, PNA MD (pediatricians)	Pre- & post- intervention data Mixed-effect models used to assess change in ABX prescribing rate. Multilevel Poisson regression analysis. Parents' wish for ABX decreased 47%. At participant level, reduced prescription rate	<u>Strengths:</u> Large pediatric population, long-standing multifaceted intervention to observe sustained effect. <u>Limitations:</u> Nationwide campaign occurred during 2 nd &

<p>intervention: The Israeli judicious antibiotic prescription study. <i>Clinical Infectious Diseases</i></p>		<p>seminars, practice campaigns, education, parent-physician communication, ABX prescription rate feedback</p> <p>DV: % prescribed ABX</p>	<p>stratified randomization</p> <p>Israel</p>	<p>24 in control group, 26 in intervention group</p> <p>C, Ad (<18 years)</p>	<p>included all ABX classes but most prominent for macrolides: intervention (58%) control (27%), relative risk 0.58, 95% CI 0.55-0.62). During 2nd & 3rd year of study ABX rates decreased by 22% (control group) & 40% (intervention group) (RR 0.76, 95% CI 0.75-0.78) – sustained after 4 yrs. At physician level, reduced overall prescription rate significantly greater in intervention than control (RR 0.89, 95% CI 0.81-0.98).</p>	<p>3rd year of study causing a significant reduction in each group ABX rates (confounder), unable to determine effect of each component in multifaceted intervention.</p> <p><u>Usefulness:</u> Long standing multifaceted intervention which providers have active roles in focus groups to develop guidelines & promote awareness can decrease ABX prescribing.</p>
<p>Butler (2012). Effectiveness of multifaceted educational programme to reduce antibiotic dispensing in primary care: practice based randomized controlled trial. <i>British Medical Journal (BMJ)</i></p>	<p>Evaluate effectiveness & costs of multifaceted educational program aimed at reducing ABX dispensing.</p>	<p>Quantitative, RCT</p> <p>Level 2</p> <p>IV: intervention consisting of audit & feedback, online education, guidelines, communication</p>	<p>68 primary care practices</p> <p>Patients served (480,000)</p> <p>Randomization of all practices then utilized dynamic block allocation to assign clinicians to intervention & control groups (34</p>	<p>All conditions</p> <p>244 clinicians (117 in control group, 127 in intervention group)</p> <p>All ages</p>	<p>Pre- & post- intervention data</p> <p>Main analysis: intention to treat & compared groups' annual rates of total ABX dispensing by ANCOVA. Other outcomes: average hospital admission rates for complications between two groups. Re-consultation rates compared with Mann-Whitney U tests.</p> <p>Rate of ABX dispensing (items per 1000 patients) intervention group with 4.2% decreased ($p=0.02$) in total ABX</p>	<p><u>Strengths:</u> Intervention discussed practice specific ABX dispensing & resistance rates, reported association between reduction in dispensing & local resistance levels.</p> <p><u>Limitations:</u> Lack of diagnosis led to not knowing which condition decrease in ABX associated with.</p>

		skills (STAR program) DV: total number of ABX dispensed per 1000 practice patients	practices in each) Wales, United Kingdom		dispensing. Reductions found for all classes of ABX other than penicillinase-resistant penicillins ($p=0.43$). No significant difference between groups with hospital admission or re-consultations. Mean annual cost of ABX dispensing fell in both groups, greater in intervention group (5.5% decrease, $p=0.07$).	Unable to determine which clinician responded most to intervention. <u>Usefulness:</u> It is possible to reduce ABX prescribing for all causes utilizing a multifaceted program.
Gerber (2013). Effect of an outpatient antimicrobial stewardship intervention on broad-spectrum antibiotic prescribing by primary care pediatricians. <i>Journal of the American Medical Association (JAMA)</i>	Evaluate the impact of an antimicrobial stewardship intervention on ABX prescribing for pediatric outpatients.	Quantitative, cluster RCT Level 2 IV: intervention consisting of clinician education with audit and feedback of ABX prescribing DV: % prescribed ABX	18 pediatric primary care practices Patients (478,012 / 293,320) Block-randomized practices (cluster) by location & volume Pennsylvania & New Jersey, USA	Sinusitis, streptococcal pharyngitis, PNA MD, NP, trainees (81 clinicians each control & intervention groups) C, Ad without complex chronic conditions, allergy to ABX or received ABX within prior 3 months	Pre- & post- intervention data Piecewise generalized linear model: prescribing pre- post-intervention between groups. Broad-spectrum ABX prescriptions decreased from 26.8% to 14.3% (absolute difference 12.5%) among intervention & from 28.4% to 22.6% (absolute difference 5.8%) in control. Broad-spectrum ABX prescribing had significant decrease for PNA (11.5%, $p<0.001$) & sinusitis (10%, $p=0.12$) with little change for strep pharyngitis (1%, $p=0.82$) & viral infections (0.2%, $p=0.93$) with intervention.	<u>Strengths:</u> Personalized audit & feedback with peer benchmarking, large sample, multiple settings, & multifaceted intervention. <u>Limitations:</u> Not able to tell which element decreased prescribing, unknown sustainability past 12 months, trend in control group possibly due to contamination across practice sites. <u>Usefulness:</u> study did show significant decrease of broad-

					Prescribing for viral infections was low at baseline & did not change.	spectrum ABX prescriptions.
Grover (2013). Addressing antibiotic use for acute respiratory tract infections in an academic family medicine practice. <i>American Journal of Medical Quality</i>	Educate providers & patient to decrease overall ABX prescription rates for ARTIs Dec 2009 to Jan 2011	Quantitative, quasi-experimental Level 3 IV: intervention of consisting academic detailing (ABX prescribing rates, guidelines, material for patients) DV: % prescribed ABX	2 primary care sites Clinicians participated in prior study; final sample of 241 patients Scottsdale AZ, USA	ARTIs 17 providers: MD (15), NP (2) C, Ad, A (≥ 5 years)	Pre- & post-intervention data Baseline ABX rates calculated; compared data from baseline to present data to determine difference in ABX prescribing rate, $p < 0.05$ statistically significant. Adult overall ABX prescribing rate decreased 13% ($p < 0.001$). Use of broad-spectrum ABX in adults decreased 9% ($p = 0.04$) Patients with risk factors for complications of ARI 6x more likely to receive ABX ($p < 0.001$) than those with no risk (46%). Diagnosis of sinusitis 8x ($p < 0.001$) or bronchitis 20x ($p < 0.001$) more likely to get ABX.	<u>Strengths:</u> ABX use decreased substantially with diagnosis of URI. <u>Limitations:</u> Small patient sample, Hawthorne effect, short time frame of data collection (Dec to March), unknown if improved behaviors are sustainable. <u>Usefulness:</u> Multifaceted intervention involving clinician & patients, reducing use of ABX for ARIs & broad-spectrum ABX use.
Vinnard (2013). Effectiveness of interventions in reducing antibiotic use for upper respiratory infections in ambulatory care	Evaluate the impact of separate interventions on ABX prescribing for uncomplicated URIs	Quantitative, quasi-experimental Level 3	Outpatient clinical settings Purposive sampling of providers #1 based on providers with			<u>Strengths:</u> Multiple interventions. <u>Limitations:</u> Possibility of contamination between groups, selection bias, & if findings generalizable.

<p>practices. <i>Population Health Management</i></p>			<p>1st & 2nd highest prevalence of ABX in 1998 #2 based on highest number of patient visits for diagnoses evaluated</p> <p>Pennsylvania, USA</p>			<p><u>Usefulness:</u> Academic detailing can reduce unnecessary ABX prescribing. Patient educational materials more successful in decreasing expectation of ABX if provided at time of visit.</p>
		<p>#1 IV: intervention consisting of academic detailing</p> <p>#1 DV: % prescribed ABX</p>	<p>Intensive intervention group (7 providers) – opinion leader, published literature & patient educ. material</p> <p>Mild intervention group (7 provider) – patient educ. material only</p> <p>Control group (14 providers) – nothing provided</p>	<p>Acute bronchitis, bronchitis not otherwise specified, cough, acute pharyngitis, acute URI</p> <p>All ages</p>	<p>Pre- & post-intervention data Generalized linear regression model with time & intervention groups as main effects & time-by-intervention interaction term.</p> <p>10% reduction in ABX prescribing for intensive intervention group (compared to no intervention ratio of odds ratio 2.60, [1.23-5.48]). No significant change in control or mild intervention group.</p>	

		<p>#2 IV: intervention consisting of patient mailing</p> <p>#2 DV: % prescribed ABX</p>	<p>Intervention group (48 providers) – patient oriented educ. material, patients mailed educ. brochure & letter signed by provider</p> <p>Control group (22 providers) – nothing provided</p>	<p>Acute bronchitis, bronchitis not otherwise specified, cough, acute pharyngitis, acute URI</p> <p>All ages</p>	<p>Pre- & post-intervention data Broad-spectrum ABX prescribing. Determined prevalence of ABX prescribing then piecewise generalized linear regression model to account for correlation within providers. Prescribing rate pre-post: intervention group decreased 4.7%, control group increased 1.2%. Not statistically significant ($p=0.133$). No change in broad/narrow spectrum ABX use.</p>	
Guideline Intervention						
<p>Weiss (2011). Impact of a multipronged education strategy on antibiotic prescribing in Quebec, Canada. <i>Clinical Infectious Diseases</i></p>	<p>Assess effect of multipronged education plan on number and cost of ABX prescriptions.</p>	<p>Quantitative, quasi-experimental Level 3</p> <p>IV: intervention consisting of guidelines providing clinical information & ABX recommendations</p> <p>DV: % prescribed ABX</p>	<p>All outpatient practices</p> <p>Bundle approach</p> <p>Quebec, Canada</p>	<p>Upper respiratory (pharyngitis, otitis media, sinusitis), lower respiratory (bronchitis, PNA), UTI, C. difficile infections</p> <p>MD & pharmacists</p> <p>All ages</p>	<p>Pre- and post-intervention data Segmented regression analysis of interrupted time series to evaluate effect of guidelines distribution on ABX prescription & costs. Calculated difference in rates of ABX prescriptions & costs per 1000 inhabitants by subtracting the rate for the province of Quebec from the rates in other Canadian provinces.</p> <p>In Quebec, number of ABX decreased by 4.2% ($p=0.002$)</p>	<p><u>Strengths:</u> large population, sustained effect on ABX prescription 36 months later.</p> <p><u>Limitations:</u> ABX guidelines produced in time where population aware of risks associated with ABX overuse (confounder)</p> <p><u>Usefulness:</u> Guidelines endorsed by professionals, actively endorsed & dispersed can have sustained</p>

					in year after intervention & persisted 36 months compared to increase by 6.5% in other provinces. ABX cost decreased by 13% in Quebec during study period and barely decreased in other provinces.	impact on ABX prescribing practices.
Venekamp (2012). Treatment of acute rhinosinusitis: discrepancy between guideline recommendations and clinical practice. <i>Family Practice</i>	Investigate whether consultation and prescription rates for acute rhinosinusitis changed after introduction of revised guidelines. 2000-2009 revised guideline introduced 2005	Quantitative, cohort study Level 4 IV: revised guideline DV: % prescribed ABX	Outpatient family practices Netherlands Total size of cohort was 31,938 patients in 2000 and 35,803 patients in 2009. 9631 patients diagnosed with acute rhinosinusitis between 2000 & 2009.	Acute rhinosinusitis MD A (≥18 years)	Pre- & post-intervention data ABX & intranasal steroid prescription rates calculated as number of prescriptions per 100 acute rhinosinusitis episodes. Trend analysis over years 2005-09: calculated rate differences. 2000 to 2005 (before revised guidelines) ABX prescription rate increased 6 prescriptions per 100 episodes ($p < 0.05$). From 2005 onwards (after new guidelines), ABX prescription rate decreased 6 per 100 episodes in 2009; rate difference -6 ($p < 0.05$). 2000 to 2009 intranasal steroid prescription rate increased 11 prescriptions per 100 ($p < 0.01$).	<u>Strengths:</u> Size of cohort & quality of data. <u>Limitations:</u> Other determinants could have decreased ABX prescription rate over time, only looked at one condition. <u>Usefulness:</u> Guidelines can be used with other interventions to help decrease ABX prescribing.
Meeker (2014). Nudging guideline-	Investigate use of posted commitment	Quantitative, randomized clinical trial	5 outpatient primary care clinics	Nasopharyngitis, laryngitis, bronchitis,	Pre- & post-intervention data Logistic mixed effects model	<u>Strengths:</u> Low-cost. Promotes shared decision making

concordant antibiotic prescribing: a randomized clinical trial. <i>JAMA Internal Medicine</i>	letter (behavioral nudge) in encouraging judicious use of ABX for ARIs.	Level 2 IV: intervention consisting of poster-sized commitment letters in exam rooms DV: % prescribed ABX	Volunteer providers meeting criteria then randomized to control & intervention (7 providers each) Los Angeles CA, USA	URI, bronchitis, pharyngitis, influenza MD (11), NP (3) A (≥18 years)	predicted inappropriate ABX prescribing; 95% CI. Inappropriate ABX prescribing decreased (9.8%) intervention group (95% CI 0 to -19.3), increase (9.9%) control group. Relative to control, posted commitment letter resulted in 19.7 absolute % reduction in inappropriate ABX prescribing ($p=0.02$).	between provider & patient. <u>Limitations:</u> Limited number of clinics, small number of clinicians, & limited time of observation. <u>Usefulness:</u> Simple, low-cost intervention (using posters alone) is effective in decreasing ABX prescribing for ARIs.
Feedback Intervention						
Naughton (2009). A RCT evaluating the effectiveness and cost-effectiveness of academic detailing versus postal prescribing feedback in changing GP antibiotic prescribing. <i>Journal of Evaluation in Clinical Practice</i>	Evaluate efficacy of academic detailing plus mailed prescribing feedback vs. only mailed prescribing feedback in decreasing overall rate of ABX March 2004 to March 2006	Quantitative, RCT Level 2 IV: intervention consisting of academic detailing & postal prescribing feedback (AD) vs. postal prescribing feedback alone (PB) DV: % prescribed ABX	98 outpatient practices 98 Volunteered practices were randomized to either intervention. AD: 48 practices w/ 55 GPs PB: 50 practices w/ 55 GPs Ireland	Clinical condition not identified MD All ages	Pre- & post-intervention data Interrupted times series segmented regression: examine within & between-group changes in prescribing in pre- & post-intervention. Regression coefficients indicating monthly % change in prescribing, 95% CI. Each intervention: 2% decrease in the rate of ABX prescribing ($p=0.26$). AD group significantly increased narrow-spectrum ABX prescribing by 5% & 2% in PB group ($p=0.04$). After 12 months, each group returned to pre-intervention prescribing.	<u>Strengths:</u> intervention able to alter pattern of ABX selection & decrease ABX use short term. <u>Limitations:</u> Lack of participation by all & lack of follow-up may have reduced effectiveness of interventions & long term sustainability not achieved. <u>Usefulness:</u> Academic detailing along with face-to-face provider feedback coupled with guidelines might have more of an impact.

<p>Linder (2010). Electronic health record feedback to improve antibiotic prescribing for acute respiratory infections. <i>American Journal of Managed Care</i></p>	<p>Examine whether providing EHR feedback improves quality of care & reduces inappropriate ABX prescribing for ARIs.</p> <p>Nov 27, 2006 to Aug 31, 2007</p>	<p>Quantitative, cluster RCT Level 2</p> <p>IV: intervention of EHR feedback with monthly reminders</p> <p>DV: % prescribed ABX</p>	<p>27 primary care practices</p> <p>Practices cluster randomized to control or intervention</p> <p>Intervention group: 14 practices w/ 258 clinicians, 8406 visits for ARI</p> <p>Control group: 13 practices w/ 315 clinicians, 10,082 visits for ARI</p> <p>Massachusetts, USA</p>	<p>ABX appropriate: PNA, strep pharyngitis, sinusitis, otitis media</p> <p>ABX inappropriate: pharyngitis, flu, acute bronchitis, nonspecific URI</p> <p>Intervention group: MD (154), Resident or Fellow (102), NP or PA (2)</p> <p>Control group: MD (188), Resident or Fellow (122), NP or PA (5)</p> <p>All ages</p>	<p>Post-intervention data</p> <p>Standard descriptive statistics to compare clinicians & patients, X² test for categorical variables & t test for continuous variables. $p < 0.05$ considered significant.</p> <p>No difference between intervention & control in ABX prescribing for ARI visits ($p = 0.87$), ABX appropriate or non-appropriate ARI visits. Only 28% usage of EHR feedback, but those users had lower overall ARI ABX rate (42%, $p = 0.02$) versus non-users (50%) & non-ABX appropriate ARIs (32%, $p = 0.004$) versus on-users (43%).</p>	<p><u>Strengths:</u> Adequate number of patients assessed</p> <p><u>Limitations:</u> No pre-intervention data of ABX use, decreased usage of EHR feedback tool, short duration of study.</p> <p><u>Usefulness:</u> Feedback: useful info to increase awareness of ABX usage. Active dissemination better. Incorporating this with other interventions may be more effective in decreasing ABX prescribing.</p>
<p>Gjelstad (2013). Improving antibiotic prescribing in acute respiratory</p>	<p>Assess effects of multifaceted educational intervention to reduce ABX</p>	<p>Quantitative, cluster RCT Level 2</p> <p>IV: intervention consists of</p>	<p>79 general practice groups</p> <p>Randomization stratified by 5</p>	<p>URI, tonsillitis, sinusitis, bronchitis, PNA, otitis media & other</p>	<p>Pre- & post- intervention data</p> <p>Multilevel logistic regression models, compared post-intervention data for intervention & control.</p>	<p><u>Strengths:</u> Large study including 10% of all general practitioners. Participants received CME credit.</p>

<p>tract infections: cluster randomized trial from Norwegian general practice (prescription peer academic detailing (Rx-PAD) study). <i>British Medical Journal (BMJ)</i></p>	<p>prescribing rates for ARTIs & reduce use of broad-spectrum ABX.</p>	<p>academic detailing – guidelines, audit & feedback, teaching seminar (intervention group) & intervention consisting academic detailing of appropriate drug treatment in patients >70 years – excluding ABX, audit & feedback, teaching seminar (control group)</p> <p>DV: % prescribed ABX</p>	<p>geographical regions, then within each stratum further randomized (39 practices in intervention & 40 practices in control group)</p> <p>Norway (southern counties)</p>	<p>respiratory tract infections</p> <p>382 clinicians (199 in control group & 183 in intervention group)</p> <p>All ages</p>	<p>1.4% reduction of ABX prescribing rates in the intervention group (33.2% to 31.8%) but a 1.6% increase in control group (33.4% to 35.0%). Prescribing of non-penicillin V ABX per 1000 patients decreased from 6.1 in intervention & increased from 6.8 in control. Less use of non-penicillin V ABX in bronchitis, sinusitis & PNA along with reduced ABX prescription rate for bronchitis.</p>	<p><u>Limitations:</u> Data did not allow separation of initial from follow-up encounters possibly underestimating ABX rates in patients with PNA. Used 13 different academic detailers could have influenced effect of intervention.</p> <p><u>Usefulness:</u> Possible to reduce ABX prescribing for ATRIs & decrease broad-spectrum ABX use utilizing academic detailing intervention.</p>
Communication Skills Intervention						
<p>Altiner (2007). Reducing antibiotic prescriptions for acute cough by</p>	<p>Assess efficacy of communication strategy intervention to</p>	<p>Quantitative, RCT Level 2</p>	<p>Outpatient practices</p> <p>Volunteered GP cluster</p>	<p>Acute cough</p> <p>MD</p> <p>Ad, A</p>	<p>Pre- & post-intervention data Baseline characteristics compared between groups, to exclude confounding effects performed two parallel</p>	<p><u>Strengths:</u> Multiple regions with adequate number of patients in study.</p>

<p>motivating GPs to change their attitudes to communication and empowering patients: A cluster-randomized intervention study. <i>Journal of Antimicrobial Chemotherapy</i></p>	<p>reduce unnecessary ABX prescriptions for acute cough. Nov 2003 to March 2005</p>	<p>IV: intervention consisting of peer visits to focus on communication with patients exploring their expectations & demands. Patients received evidence-based information about illness & ABX DV: % prescribed ABX</p>	<p>randomization of practice to intervention or control group Intervention group: baseline 52 GPs w/ 1389 pts, 6 wks. after intervention 42 GPs w/ 1021 pts, 12 mo. after intervention 28 GPs w/ 787 pts. Control group: baseline 52 GPs w/ 1398 pts, 6 wks. after intervention 44 GPs w/ 1143 pts, 12 mo. after intervention 33 GPs w/ 920 pts. Germany (9 regions)</p>	<p>(≥ 16 years)</p>	<p>analyses of data. Relative changes from baseline reported as odds ratios. Intervention group ABX rate decreased 7% ($p<0.001$) @ 6 weeks after intervention and increased to baseline after the year ($p=0.028$). Control group ABX rate increased to 4.7% ($p=0.001$) @ 6 weeks after intervention & increased another 5.4% after the year ($p=0.044$). The odds ratio corresponds to a relative reduction in ABX prescription rates of ~60% at 6 weeks & continual 40% at 12 months.</p>	<p><u>Limitations:</u> % of GPs dropped out of study (was equal in both groups), Jan 2004 OTC medicines excluded from reimbursement possibly increasing ABX use. <u>Usefulness:</u> Communication strategies involving shared decision making with patients & patient education resulted in immediate decrease of ABX prescribing and was sustained over year period without further interventions.</p>
<p>Légaré (2012). Training family physicians in shared decision-making to reduce to overuse of antibiotics in</p>	<p>Evaluate effect of a shared decision-making training program on percentage of</p>	<p>Quantitative, cluster RCT Level 2 IV: intervention consisting of online & interactive</p>	<p>9 outpatient family practices Cluster randomization of practices to intervention or control group</p>	<p>ARI Intervention group: MD & residents (77)</p>	<p>Pre- & post-intervention data Generalized linear mixed model procedure to determine % of patients who decided to use ABX immediately after consultation.</p>	<p><u>Strengths:</u> Multiple regions viewed. <u>Limitations:</u> Did not control for other external variables, small sample size</p>

<p>acute respiratory infections: A cluster randomized trial. <i>Canadian Medical Association Journal</i></p>	<p>patient who decides to take ABX after consultation with clinician. July 2010 to April 2011</p>	<p>seminars (shared decision making, education of signs and symptoms, communication strategies, & decision support tools) (DECISION+2) DV: % prescribed ABX</p>	<p>then stratified according to location Intervention group: 5 practices, 181 pts Control group: 4 practices, 178 pts 6 regions in Quebec</p>	<p>Control group: MD & residents (72) All ages</p>	<p>Cochran-Armitage trend test to assess perception that shared decision-making occurred & quality of decision made. % of patients who decided to use ABX after consultation increased 13% control group & decreased 14% intervention group, absolute difference of 25%. DECISION+2 associated with patients' active role in decision-making process (49%) vs. control group (67%), $z=3.9, p<0.001$.</p>	<p><u>Usefulness:</u> Multifaceted intervention involving communication strategies & shared decision making with patients is effective at decreasing ABX prescribing for ARIs.</p>
<p>Little (2013). Effects of internet-based training on antibiotic prescribing rates for acute respiratory-tract infections: A multinational, cluster, randomised, factorial, controlled trial. <i>Lancet</i></p>	<p>Assess whether internet-based training methods could alter prescribing practices in multiple health-care systems. Oct - Dec 2010 (baseline data) Feb - May 2011 (recruit patients)</p>	<p>Quantitative, RCT Level 2 IV: intervention of C-reactive protein (CRP) testing or communication training or both DV: % prescribed ABX</p>	<p>246 outpatient practices Practices cluster randomized to 4 groups Control: 53 clinics w/ 870 pts. CRP testing: 58 clinics w/ 1062 pts. Communication : 55 clinics w/ 1170 pts. CRP & communication</p>	<p>Lower & Upper respiratory tract infections MD Ad, A (>18 years)</p>	<p>Pre- & post-intervention data Analysis done by intention to treat & used multilevel logistic regression modeling to assess ABX use. Secondary analysis done for individual groups. Baseline ABX rate 55.3%. Post intervention: ABX rate increased 3.1% in control, decreased 15% CRP & 9% communication (each with $p<0.0001$). Individual group results: ABX rate increased 3.3% in control & decreased in CRP 20.3%</p>	<p><u>Strengths:</u> Large numbers patients & clinics, multiple countries, interventions transferable between settings. <u>Limitations:</u> Diagnostic value of CRP testing. <u>Usefulness:</u> Multifaceted communication intervention effective in decreasing ABX prescribing. CRP testing in patients</p>

			(both): 62 clinics w/ 1162 pts. 6 European Countries		($p < 0.0001$), communication 14.3% ($p = 0.003$), both 23.3% ($p < 0.0001$).	might not be feasible in all practices.
--	--	--	---	--	---	---

ABX = antibiotic, RCT = randomized control trial, EHR = electronic health record

¹ **Design: qualitative with specific design, quantitative with specific design, systematic review qualitative with meta-synthesis, systematic review quantitative, evidence based practice guideline (EBPG)**

² **Evidence Level: Hierarchy of evidence rated 1 to 7 per Melnyk & Fineout-Overholt (2015)**

³ **Variables: independent (IV), dependent (DV)**

^{4a} **Sample = providers surveyed (#)**

^{4b} **Sample = patients served (# pre-intervention / # post-intervention)**

⁵ **Clinical Condition: acute respiratory tract infection (ARTI or ARI), upper respiratory infection (URI), chronic obstructive pulmonary disorder (COPD), urinary tract infections (UTI), skin and soft tissue infections (STI), pneumonia (PNA)**

⁶ **Provider: physicians (MD), nurse practitioners (NP), physician assistants (PA)**

⁷ **Patient Age: children (C), adolescent (Ad), adult (A)**

Appendix B
Application of Theory

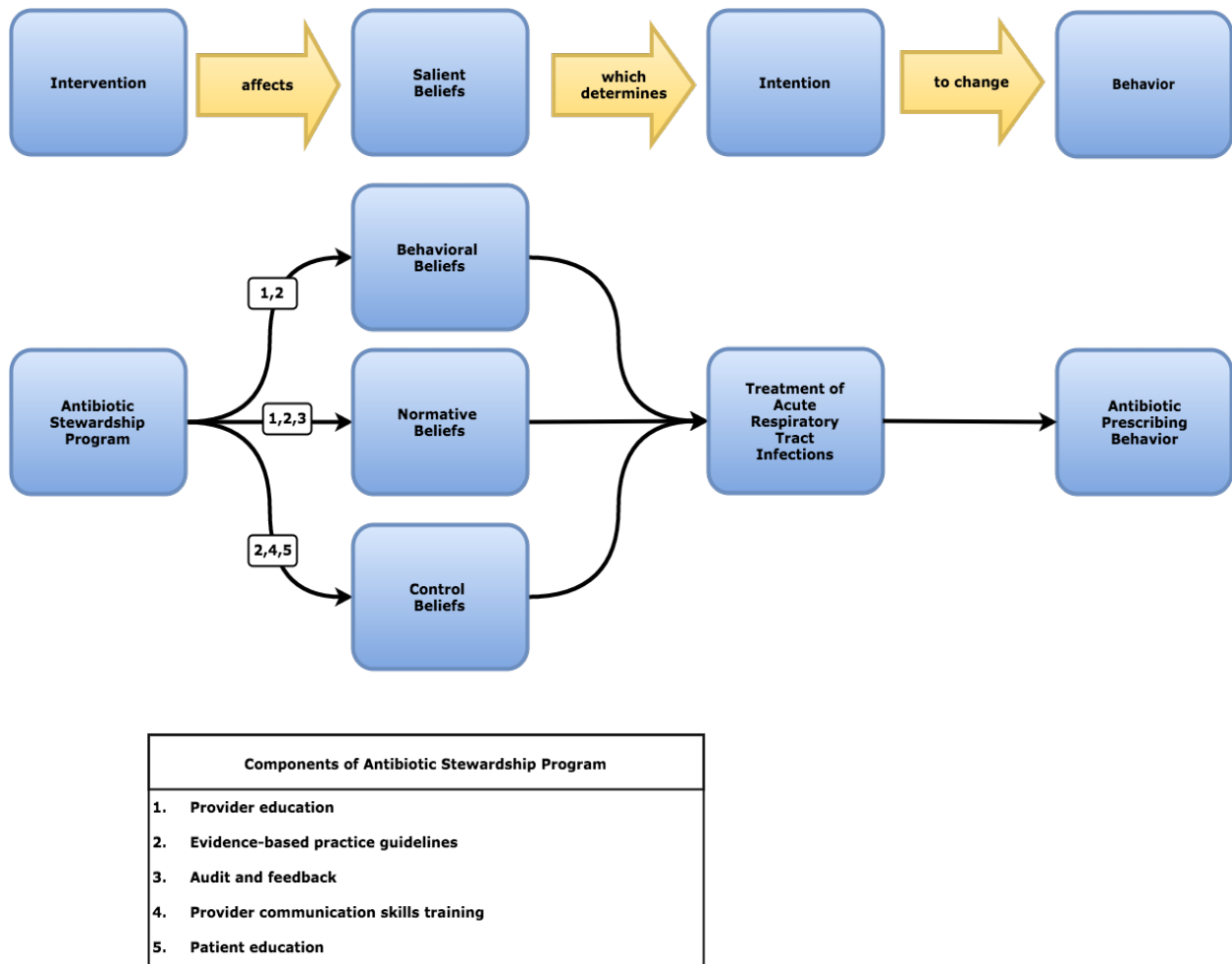


Figure B1. DNP project conceptual framework. Demonstrates affect antibiotic stewardship program has on changing healthcare providers antibiotic prescribing behavior for acute respiratory tract infections. Numbers denote appropriate interventions as described in key. Adapted from Icek Ajzen’s theory of planned behavior.

Appendix C

IRB Approval

IRB Authorization Agreement

Name of Institution or Organization Providing IRB Review (Institution A):

IRB Registration #: Federalwide Assurance (FWA) #:

Name of Institution Relying on the Designated IRB (Institution B):

Federalwide Assurance (FWA) #:

The Officials signing below agree that Institution B may rely on the designated IRB for review and continuing oversight of its human subject research described below (check one):

This agreement applies to all human subject research covered by Institution B's FWA.

This agreement is limited to the following specific protocol(s):

Name of Research Project:

Name of Principal Investigator (Institution A):

Name of Principal Investigator (Institution B):

Please identify the extent of your involvement in this project as an agent of Institution B:

Sponsor or Funding Agency: Award #, if any:

Other (describe):

The review and continuing oversight performed by the designated IRB will meet the human subjects protection requirements of Institution B's OHRP-approved FWA. The IRB at Institution A will follow written procedures for reporting its findings and actions to appropriate officials at Institution B. Relevant minutes of IRB meetings will be made available to Institution B upon request. Institution B remains responsible for ensuring compliance with the IRB's determinations and with the terms of its OHRP-approved Assurance. This document must be kept on file at both institutions and provided to OHRP upon request.

Signature of Signatory Official (Institution A): Date:

Printed Name: Title:

Printed Name: Title:




Signature of Signatory Official (Institution B): Date:


Page of

Figure C1. IRB authorization agreement.

Appendix C


IRB Approval

  **HOSPITAL** 

 Hospital IRB Identifier (IRB00002453) (FWA00003303)
FWA Expiration Date: September 20, 2016

DATE: July 25, 2016

TO: Cynthia Brown, MSN

FROM:  Hospital IRB

STUDY TITLE: [938910-1] Reducing Outpatient Antibiotic Resistance


IRB REFERENCE #: 2016.013


SUBMISSION TYPE: New Project

Advertisement - Recruitment Script (SUBMITTED: 07/20/2016)

Advertisement - Recruitment Flyer (SUBMITTED: 07/20/2016)

Application Form - Chart Review Initial Application (SUBMITTED: 07/20/2016)


Application Form - IRB_Initial_Review_Application_  (SUBMITTED: 07/20/2016)

Conflict of Interest - Other -  Disclosure of Financial Interest (SUBMITTED: 07/22/2016)

Conflict of Interest - Other - Disclosure Statement of Financial Interests page 2 (SUBMITTED: 07/20/2016)

Conflict of Interest - Other - Disclosure Statement of Financial Interests page 1 (SUBMITTED: 07/20/2016)

Consent Form - Informed Consent.doc (SUBMITTED: 07/20/2016)

CV/Resume -  CV (SUBMITTED: 07/20/2016)

CV/Resume - Cynthia Brown CV (SUBMITTED: 07/20/2016)

- 1 - Generated on IRBNet

Figure C2. IRB Approval page 1 of 3.

Appendix C

IRB Approval

Other - University of Missouri - Kansas City Project Approval Letter (SUBMITTED: 07/20/2016)

Protocol - IRB Protocol (SUBMITTED: 07/20/2016)

Questionnaire/Survey - Providers' Attitudes and Knowledge Concerning Antibiotic Prescription and Resistance (SUBMITTED: 07/20/2016)

Training/Certification - CITI Training [REDACTED] (SUBMITTED: 07/20/2016)

Training/Certification - CITI Training Cynthia Brown (SUBMITTED: 07/20/2016)

Training/Certification - CITI Training Cynthia Brown (SUBMITTED: 07/20/2016)

ACTION: APPROVED
APPROVAL DATE: July 25, 2016
INITIAL APPROVAL DATE: July 25, 2016
EXPIRATION DATE: July 24, 2017
REVIEW TYPE: Expedited Review

Thank you for your submission of New Project materials for this research study. The [REDACTED] Hospital IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the study and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the study via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate adverse event forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

Please report all NON-COMPLIANCE issues or COMPLAINTS regarding this study to this office.

- 2 -

Generated on IRBNet

Figure C3. IRB Approval page 2 of 3.

Appendix C

IRB Approval

Please note that all research records must be retained for a minimum of three years.

Based on the risks, this project requires Continuing Review by this office on an annual basis. Please use the appropriate renewal forms for this procedure.

If you have any questions, please contact [REDACTED]
Please include your study title and reference number in all correspondence with this office.

Signature is not required as this document was generated in accordance with [REDACTED] Hospital's IRB policy. This process is consistent with Federal regulations and [REDACTED] Hospital's standard operating policies with respect to the IRB and the Human Research Protection Office, which consider electronically generated documents as official notice to sponsors and others of approval, disapproval or other IRB decisions. A copy has been retained within [REDACTED] Hospital's records.

- 3 - Generated on IRBNet

Figure C4. IRB Approval page 3 of 3.

Appendix D

Site Approval Letter

School of Nursing
University of Missouri – Kansas City
2464 Charlotte Street
Kansas City, MO 64108

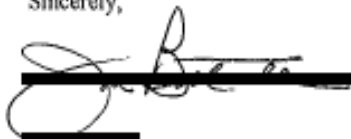
Subject: Site Approval Letter

To whom it may concern:

This letter acknowledges that I have received and reviewed a request by Cynthia Brown, DNP Student at University of Missouri – Kansas City, to conduct a research project entitled "*Reducing Outpatient Antibiotic Resistance*" at [redacted] Hospital and Urgent Care Centers and I approve of this research to be conducted at our facility during 2016 to May 2017.

When the researcher receives approval for her research project from [redacted] Hospital Institutional Review Board (IRB), I agree to provide access for the approved research project. If we have any concerns or need additional information, we will contact the researcher [redacted] or [redacted] Hospital IRB analyst [redacted]

Sincerely,



Vice President [redacted] Hospital

7/25/2016
(Date)

Appendix E

Cost for Reducing Outpatient Antibiotic Resistance Project


Direct Costs	Amount
Printing AWARE brochures (color)	10.30
Printing MARR clinical PEARLS (black and white)	2.10
Printing course presentation and evaluations (black and white)	29.40
Printing Snellman EBPG (black and white)	6.30
Printing Snot Chart (color)	6.90
Folders	4.00
Printing consent forms	14.70
Printing presentation flyers (black and white)	1.47
Printing presentation flyers (color)	4.83
<i>Total Direct Costs</i>	80.00
Indirect Costs	Amount
Catered food for education sessions	120.00
Gift cards for completion of survey @ \$25/card for 8 cards	200.00
Encrypted USB drive for data	50.00
Dissemination of project @ APNO conference	678.00

Appendix F

Study Recruitment Flyer

Volunteers Needed for Research Study

**We need participants for research in
Antibiotic Prescribing**



We are looking for volunteers to take part in a study of healthcare providers' knowledge, attitude and practice concerning antibiotic use and resistance.

To participate: You must be currently employed as a medical provider (Nurse Practitioner or Physician) at any one of the [REDACTED] Urgent Care Centers.

If you are interested and agree to participate you would be asked to:

complete a 15-minute anonymous online computer-based questionnaire and
participate in one 60-minute educational seminar**
on the [REDACTED] Hospital campus
Institute for Health Education Conference room #4
September 20, 2016 or September 29, 2016 from 6:30am to 7:30am.*

For more information about this study, or to volunteer for this study,
please contact:
Cynthia Brown at [REDACTED]

*In appreciation for your time, you will receive a gift card.

**[REDACTED] Hospital is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians.

**[REDACTED] Hospital designates this live activity for a maximum of 1.0 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

This research is conducted under the direction of Dr. Lyla Lindholm and Dr. David LaFevers, University of Missouri – Kansas City School of Nursing, and has been reviewed and approved by the [REDACTED] Hospital Institutional Review Board.

Appendix G
 Recruitment Script

Recruitment Script

Introduction of Investigator

Excuse me, Nurse Practitioner/Doctor Smith. Do you have a minute? My name is Cynthia Brown. I am a doctoral nurse practitioner student at the University of Missouri – Kansas City and I am conducting a research study for my evidence-based practice scholarly project. You received information about this study from the flyer sent via email or displayed in the Urgent Care Centers.

Immediate Opportunity to Opt-Out

I am here to follow up on the flyer and to see if you are interested in hearing more about my study. Is it OK for me to continue?

- If individual says “no, not interested” = stop, say thank you but do not continue.
- If he/she says “yes”, then continue or make plans to revisit at a more convenient time.

Brief Statement About Why He/She was Selected

I am approaching you because I am looking for healthcare providers (physicians and nurse practitioners) working within [REDACTED] Urgent Care Centers. This research is totally separate from your employment at [REDACTED] and whether or not you decide to hear more about the research will not affect your employment status.

Ask if Interested in Hearing More Details

So, are you interested in hearing some details about the research study?

- If not interested, thank the individual for his/ her time.
- If interested, then continue to consent form.

[REDACTED] Hospital Institutional Review Board (IRB) for Human Research Stamp of Certification	
Approved on:	July 25, 2016
Expires on:	July 24, 2017
Study number:	2016.013
IRB Chairperson Signature:	<i>[Signature]</i>
Staff Initials:	<i>[Initials]</i>

Appendix H

Presentation Evaluation

Name of Event: Reducing Outpatient Antibiotic Resistance					
Group: Urgent Care Providers					
Date:			Time: 6:30 am to 7:30 am		
Location: Institute for Health Education conference room #4					

Part I. Please give feedback on how well this session met its objective (indicate your response by circling the number):

Objective 1: To promote antibiotic prescribing practice per guidelines to improve quality care.

	Low				High
Relevance of Content	1	2	3	4	5
Clarity of Presentation	1	2	3	4	5
Relevance to your learning	1	2	3	4	5

Objective 2: To provide healthcare providers with literature and statistics related to antibiotic resistance and overuse.

	Low				High
Relevance of Content	1	2	3	4	5
Clarity of Presentation	1	2	3	4	5
Relevance to your learning	1	2	3	4	5

Objective 3: To provide healthcare providers education regarding acute respiratory infections and treatment.

	Low				High
Relevance of Content	1	2	3	4	5
Clarity of Presentation	1	2	3	4	5
Relevance to your learning	1	2	3	4	5

Objective 4: To provide healthcare providers with feedback regarding current antibiotic prescribing rates and beliefs and knowledge regarding antibiotic resistance and use.

	Low				High
Relevance of Content	1	2	3	4	5
Clarity of Presentation	1	2	3	4	5
Relevance to your learning	1	2	3	4	5

(turn over to continue)

Figure H1. Presentation evaluation page 1 of 2

Appendix H

Presentation Evaluation

Part II. Evaluation of Session

a) What did you learn from the session that was new?

b) How can you apply this new information in the future?

c) Other comments and suggestions

Part III. Presenter

a) How do you rate the presentation (organization, use of audio-visuals, handouts, etc.)?

Low					High
1	2	3	4	5	

b) Please rate the knowledge of the speaker?

Not Knowledgeable					Knowledgeable
1	2	3	4	5	

c) How do you rate the presentation skills of the speaker?

Low					High
1	2	3	4	5	

d) Overall rating

Poor	Average		Excellent
1	2	3	

Figure H2. Presentation evaluation page 2 of 2

Appendix I

Informed Consent and Privacy Authorization

IRB #2016.013
RESEARCH PARTICIPANT INFORMED CONSENT AND PRIVACY AUTHORIZATION FORM
<input type="checkbox"/> Adult <input type="checkbox"/> Minor
Participant: _____ Date: _____
Principal Investigator: <u>Cynthia Brown, Doctor of Nursing Practice student at University of Missouri – Kansas City</u>
Telephone#: [REDACTED]
Email Address: [REDACTED]
Sponsor: None
<hr/> STUDY TITLE: Reducing Outpatient Antibiotic Resistance <hr/>
1. What you should know about this study:
<p>This is a research study. Research studies include only people who choose to volunteer. As a study participant you have the right to know about the procedures that will be used in this research study so that you can make the decision whether or not to volunteer. The information presented here is simply an effort to make you better informed so that you may give or withhold your consent to volunteer in this research study.</p>
<p>Please take your time to make your decision and discuss it with your family and friends.</p>
<p>You are being asked to take part in this study because you are a medical provider at [REDACTED] Urgent Care Centers.</p>
<p>In order to participate in this study, it will be necessary to give your written consent.</p>
<p>Why is this study being done?</p>
<p>The purpose of this study is to evaluate provider antibiotic prescribing for acute respiratory infections, knowledge and attitudes regarding antibiotic use and resistance and differences among nurse practitioners and physician.</p>
<p>Currently, within the [REDACTED] system there is no outpatient antibiotic stewardship program.</p>
<p>This research will find out what effects an antibiotic stewardship program, 1-hour provider education seminar, has on you and your antibiotic prescribing behavior.</p>
<p>This research will also compare the similarities or differences of healthcare providers, nurse practitioners and physicians, knowledge and attitudes regarding antibiotic use and resistance.</p>
<small>Initial IRB Consent Approval Date: 7-25-2016 Last IRB Review Date: Version 7-2016</small>
<small>Page 1 of 7</small>

Figure II. Informed consent page 1 of 7

Appendix I

Informed Consent and Privacy Authorization

This study involves less than a minor increase over minimal risk. This means this study involves procedures that are less than or equal to the risks that you come across in your everyday life.

2. How many people will take part in the study?

35 participants, nurse practitioners and physicians, are expected to take part in the study at [REDACTED] Hospital Urgent Care Centers.

3. What will happen if you join this study?

If you agree to be in this study, we will ask you to do the following things:

- Anonymously complete a secure online questionnaire consisting of a 29-item survey and an 8-item socio-demographic and professional data information section.
- Participate in a 1-hour educational seminar in September 2016.

If you agree to be in this study, the following things will be done:

- A chart review of your patients with acute respiratory infections will be completed prior to and after the 1-hour educational seminar to obtain data for research purposes.
- Results of the chart reviews and questionnaires prior to the educational seminar will be provided to you at the seminar. Results of the chart reviews after the educational seminar will be provided to you by May 2017.

If you agree to be in the study, the following information will be used for study purposes:

- The online questionnaire contains questions to assess provider knowledge and attitudes influencing antibiotic prescribing behavior and provider demographic data noting provider age, gender, type of provider, number of years practicing, years at an urgent care center, approximate number of patients seen per day, and average time spent with patients.
- The chart review will obtain patient information noting the date of service, clinic site, provider and type, patient age, sex, race, past medical history, allergies, duration of illness, diagnostic tests performed with results, antibiotic prescribed and antibiotic name, and dose and duration of treatment.

Future use of study information will not include identifiable data or material.

4. How long will I be in the study?

We think you will be in the study for a total of 3 months.

You will complete an online survey and demographic information in August 2016 and it should take approximately 5 to 10 minutes in duration.

You will attend an active 1-hour educational seminar in September 2016 at [REDACTED] Institute for Health Education conference center located on the 2nd level of the North Medical Building on [REDACTED] campus.

The total time expected of researcher completing the research activities is estimated at five months.

Initial IRB Consent Approval Date: 7-25-2016
Last IRB Review Date:
Version 7-2016

Page 2 of 7

Figure I2. Informed consent page 2 of 7

Appendix I

Informed Consent and Privacy Authorization

5. What are the risks or discomforts of the study?

This study involves less than a minor increase over minimal risk. This means this study involves procedures that are less than or equal to the risks that you come across in your everyday life.

There are certain risks and discomforts that may occur if you take part in this research study. You may experience one or more of the risks indicated below from being in this study. In addition to these, there may be other unknown risks, or risks that we did not anticipate, associated with being in this study.

There are no risks associated with joining the study as compared with the risks associated with continuing standard medical practice.

Reasonably foreseeable risks, discomforts or inconveniences associated with this study are minimal but could likely include:

- Loss of time.
- Professional, peer or social uneasiness.
- Feelings of pressure to engage in the study.
- Breach in confidentiality of sensitive information.

6. Are there risks related to pregnancy?

No.

Breast Feeding Risk

No.

7. Are there benefits to being in the study?

Your participation in the study will expand your personal and professional knowledge and provide access to resources.

If you take part in this study, you may help others in the future by greatly optimizing infectious treatment, reducing unnecessary adverse drug effects associated with antibiotic use and reducing the threat of antibiotic resistance.

8. What are your alternative options if you do not want to be in the study?

If you choose not to join this study, you will continue with standard medical practices and your employment at ██████████ Hospital will not be affected.

9. Will it cost you anything to be in this study?

The only costs associated with participating in the study is associated with your time. Otherwise, there are no costs to you for being a part of this research study.

Initial IRB Consent Approval Date: 7-25-2016
Last IRB Review Date:
Version 7-2016

Page 3 of 7

Figure I3. Informed consent page 3 of 7

Appendix I

Informed Consent and Privacy Authorization

10. Will you be paid if you join this study?

You will receive a gift card for \$25 for completing the online survey.

At the end of the online questionnaire, you will be given instructions on how to receive the gift card.

11. Can you leave the study early?

You can agree to be in the study now and change your mind later.

If you wish to stop, please tell us right away.

Your participation is voluntary and your decision whether or not to participate will not prejudice your relations with [REDACTED] Hospital, Urgent Care Centers or other affiliated services or affect your employment status.

If you choose to participate in the study, you are free to stop participating and withdraw your consent at any point in time without penalty.

If you choose to withdraw after completing the online questionnaire, data collected may be used as part of the research.

12. Why might we take you out of the study early?

You may be taken out of the study if:

- The study is cancelled.
- There may be other reasons to take you out of the study that we do not know at this time.

13. How will your privacy be protected?

[REDACTED] Hospital has rules to protect information about you. Federal and state laws also protect your privacy.

The research team working on the study will collect information about you. This includes information learned from the procedures described in this consent form. They may also collect other information including your name, address, date of birth, and other details.

Usually, only people on the research team will know your identity and that you are in the research study. However, sometimes other people at [REDACTED] Hospital may see or give out your information. These include: the people who review research studies, their staff, lawyers, or other [REDACTED] Hospital staff.

People outside of [REDACTED] Hospital may need to see your information for this study. Examples include: government groups (such as the Food and Drug Administration), safety monitors, [REDACTED] Hospital IRB, University of Missouri – Kansas City professors and statistician, and companies that sponsor the study.

We cannot do this study without your permission to use and give out your information. You do not have to give us this permission. If you do not, then you may not join this study.

We will use and disclose your information only as described in this form and in our Notice of Privacy Practices; however, people outside [REDACTED] Hospital who receive your information may not be covered by

Figure 14. Informed consent page 4 of 7

Appendix I

Informed Consent and Privacy Authorization

this promise. We try to make sure that everyone who needs to see your information keeps it private, but we cannot guarantee this.

The use and disclosure of your information has no time limit. You may cancel your permission to use and disclose your information at any time by getting in contact with the Principal Investigator or Study Staff by phone and in writing.

If you call the Principal Investigator, you must follow-up with a written request that includes the study number and your contact information. The Principal Investigator's name, address, phones and fax information are on page one of this consent form.

If you cancel your permission to use and disclose your information, your part in this study will end. No more information about you will be collected. Previous information collected would remain part of the study.

Additional information regarding this study:

Data collected from the patient chart will not include personal information, will be coded to conform with Health Insurance Portability and Accountability Act, and will be stored on an encrypted USB flash drive kept in a locked cabinet at [REDACTED] Urgent Care Center to limit breach in confidentiality.

All information from the patient chart will have a code assigned for the provider and patient and kept independent of the data spreadsheet.

The provider questionnaire data will be captured via an online secure database, University of Missouri – Kansas City REDCap, and de-identified as to not associate responses to an individual provider.

14. What does a conflict of interest mean to you as a participant in this study?

When a person or an organization has a financial or other interest large enough to seem as if it could affect their judgment, we call this a conflict of interest. The investigator in this study has a conflict of interest in connection with this study and the following paragraph(s) tell(s) you about it.

The only foreseeable Principal Investigator conflicts will be performing the study within the same facility in which patients are seen and treated by the Principal Investigator. As a result, the urgent care center associated with the Principal Investigator practice will not be utilized in the study to reduce biases and possibility of confounding factors that might interfere with assessing the relationship between the intervention and the outcomes.

15. What are my rights if I take part in this study?

Taking part in this study is your choice. You may choose either to take part or not to take part in the study. If you decide to take part in this study, you may leave the study at any time. No matter what decision you make, there will be no penalty to you and you will not lose any of your employment benefits. Leaving the study will not affect your employment status at [REDACTED].

We will tell you about new information or changes in the study that may affect your willingness to stay in the study.

In the case of injury resulting from this study, you do not lose any of your legal rights to seek payment by signing this form.

Initial IRB Consent Approval Date: 7-25-2016
Last IRB Review Date:
Version 7-2016

Page 5 of 7

Figure I5. Informed consent page 5 of 7

Appendix I

Informed Consent and Privacy Authorization

16. Where can I get more information?

You may contact Cynthia Brown at [REDACTED]

17. What other things should you know about this research study?

If you have any questions regarding your rights as a participant in this research and/or concerns about the study, you may contact [REDACTED] Hospital Institutional Review Board (IRB). The IRB is made up of:

- Doctors
- Allied Health Care Workers
- Nurses
- Non-scientists
- and people from the local community.

The IRB reviews human research studies. It protects the rights and welfare of the people taking part in those studies. You may contact the IRB if you have questions about your rights as a participant or if you think you have not been treated fairly. The IRB office number is [REDACTED]. You may also call this number for other concerns or questions about the research.

You may ask more questions about the study at any time. For questions about the study or a research-related injury, contact *Cynthia Brown* at [REDACTED].

Data from this study may be published, but individual patients will not be identified in these publications. Efforts will be made to keep your personal information confidential. The data, tissue, blood, and samples collected from you during this study are important to both this study and to future research.

If you join this study:

- [REDACTED] Hospital and/or its outside partners in this research will own these data, tissue, blood and samples.
- [REDACTED] Hospital and/or its outside partners in this research may only use materials or data that identify you for future research with your consent or IRB approval.
- If this material is used to create a product or idea, Cynthia Brown will own that product or idea.
- You will not receive any financial benefit from the creation, use or sale of that product or idea.

18. What does your signature on this consent form mean?

Your signature on this form means that:

- You understand the information given to you in this form
- You have had the chance to ask questions
- You agree to join the study
- You will follow the study rules as described in this consent form

You will not give up any legal rights by signing this consent form.

WE WILL GIVE YOU A COPY OF THIS SIGNED AND DATED CONSENT FORM

Initial IRB Consent Approval Date: 7-25-2016
 Last IRB Review Date:
 Version 7-2016

Page 6 of 7

Figure I6. Informed consent page 6 of 7

Appendix I

Informed Consent and Privacy Authorization

SIGNATURES

I confirm that the purpose of the research, the study procedures, the possible risks and discomforts as well as potential benefits that I may experience have been explained to me. Alternatives to my participation in the study also have been discussed. I have read this consent form and my questions have been answered. My signature below indicates my willingness to participate in this study: **Reducing Outpatient Antibiotic Resistance.**

_____ Date _____
 Study Participant

_____ Date _____
 Legal Guardian/Advocate/Witness (if required)

My signature on this consent form means that I agree that _____ is currently incompetent and that I consent on his/her behalf to him/her taking part in this study and agree to the use of his/her health information as previously described in this consent.

Participant's Legal Representative or
 Guardian Signature: _____ Date: _____

I have explained the purpose of the research, the study procedures, identifying those that are investigational, the possible risks and discomforts as well as potential benefits and have answered questions regarding the study to the best of my ability.

Principal Investigator/Representative _____ Date _____

Do not sign after the expiration date of: July 24, 2017

NOT VALID WITHOUT THE IRB STAMP OF APPROVAL

Hospital Institutional Review Board (IRB) for Human Research Stamp of Certification	
Approved on	July 25, 2016
Expires on	July 25, 2017
Study number	2016.012
IRB Chairperson Signature	<i>[Signature]</i>
Staff Initials	<i>[Initials]</i>

Initial IRB Consent Approval Date: 7-25-2016
 Last IRB Review Date:
 Version 7-2016

Page 7 of 7

Figure 17. Informed consent page 7 of 7

Appendix J

Provider REDCap Questionnaire

[REDACTED] Hospital Institutional Review Board (IRB) for Human Research Review of Certification	
Approval:	August 25, 2016
Expires:	12/31/2017
IRB Number:	2016-011
IRB Contact Person:	[REDACTED]
IRB Email:	[REDACTED]

Dear Provider,

You are being asked to participate in a research study surveying nurse practitioners and physicians in urgent care regarding your knowledge, attitudes and practices towards antibiotic prescribing and antibiotic resistance.

The survey is voluntary, anonymous and you cannot be linked in any way to your responses so please answer as best you can and take this survey only once.

It will take you approximately 5 minutes to complete the whole survey. If you are unable to complete the survey once opened, you have the option to save and return at a later time. If you choose this option, you will be provided an auto-generated return code which is required to continue the survey.

Your participation is greatly appreciated.

Thank you for your time!

You may open the survey in your web browser by clicking the link below:
[Providers' Attitudes and Knowledge Concerning Antibiotic Prescription and Resistance](#)

If the link above does not work, try copying the link below into your web browser:
<https://redcap.umkc.edu/surveys/?s=4hffvGLCjN>

This link is unique to you and should not be forwarded to others.

Figure J1. Email for provider questionnaire via REDCap

Appendix J

Provider REDCap Questionnaire

Confidential

Page 1 of 4

Providers' Attitudes and Knowledge Concerning Antibiotic Prescription and Resistance

You are being asked to participate in a research study surveying nurse practitioners and physicians in urgent care regarding your knowledge, attitudes and practices towards antibiotic prescribing and antibiotic resistance.

The survey is voluntary, anonymous and you cannot be linked in any way to your responses so please answer as best you can and take this survey only once.

It will take you approximately 5 minutes to complete the whole survey. If you are unable to complete the survey once opened, you have the option to save and return at a later time. If you choose this option, you will be provided an auto-generated return code which is required to continue the survey.

Your participation is greatly appreciated. Please complete the survey below.

Principal Investigator: [Redacted]

IRB #: [Redacted]

IRB Approval Date: [Redacted]

IRB Expiration Date: [Redacted]

IRB Protocol #: [Redacted]

IRB Protocol Title: [Redacted]

IRB Protocol Number: [Redacted]

IRB Protocol Version: [Redacted]

IRB Protocol Status: [Redacted]

IRB Protocol Description: [Redacted]

IRB Protocol Location: [Redacted]

IRB Protocol Contact: [Redacted]

IRB Protocol Phone: [Redacted]

IRB Protocol Email: [Redacted]

IRB Protocol Website: [Redacted]

IRB Protocol Address: [Redacted]

IRB Protocol City: [Redacted]

IRB Protocol State: [Redacted]

IRB Protocol Zip: [Redacted]

IRB Protocol Country: [Redacted]

IRB Protocol Sponsor: [Redacted]

IRB Protocol Sponsor Address: [Redacted]

IRB Protocol Sponsor City: [Redacted]

IRB Protocol Sponsor State: [Redacted]

IRB Protocol Sponsor Zip: [Redacted]

IRB Protocol Sponsor Country: [Redacted]

IRB Protocol Sponsor Phone: [Redacted]

IRB Protocol Sponsor Email: [Redacted]

IRB Protocol Sponsor Website: [Redacted]

IRB Protocol Sponsor Address: [Redacted]

IRB Protocol Sponsor City: [Redacted]

IRB Protocol Sponsor State: [Redacted]

IRB Protocol Sponsor Zip: [Redacted]

IRB Protocol Sponsor Country: [Redacted]

Thank you for your time!

INSTRUCTIONS

In the left column are questions that will be the subject of your evaluation and in the right column there is a gradual scale where you should place the slider where, according to your opinion represents your agreement with the text comment. If you are totally in disagreement, you should place the slider at the left end, and as your agreement increases you should move the slider to the right.

Totally Disagree
(0%)

Totally Agree
(100%)

(Place a mark on the scale above)

ABOUT ANTIBIOTICS AND RESISTANCE

1. Antibiotic resistance is an important Public Health problem in OUR SETTING.

Totally Disagree
(0%)

Totally Agree
(100%)

(Place a mark on the scale above)
2. In a primary-care context, one should wait for the microbiology results before treating an infectious disease.

Totally Disagree
(0%)

Totally Agree
(100%)

(Place a mark on the scale above)
3. Rapid and effective diagnostic techniques are required for diagnosis of infectious diseases.

Totally Disagree
(0%)

Totally Agree
(100%)

(Place a mark on the scale above)
4. The prescription of an antibiotic to a patient does not influence the possible appearance of resistance.

Totally Disagree
(0%)

Totally Agree
(100%)

(Place a mark on the scale above)

06/08/2016 1:19am www.projectredcap.org

Figure J2. Provider questionnaire via REDCap page 1 of 4.

Appendix J

Provider REDCap Questionnaire

Confidential Page 2 of 4

5. I am convinced that new antibiotics will be developed to solve the problem of resistance. Totally Disagree (0%) Totally Agree (100%)

 (Place a mark on the scale above)

6. The use of antibiotics on animals is an important cause of the appearance of new resistance to pathogenic agents in humans. Totally Disagree (0%) Totally Agree (100%)

 (Place a mark on the scale above)

7. In case of doubt, it is preferable to use a wide-spectrum antibiotic to ensure that the patient is cured of an infection. Totally Disagree (0%) Totally Agree (100%)

 (Place a mark on the scale above)

8. I frequently prescribe an antibiotic in situations in which it is impossible for me to conduct a systematic follow-up of the patient. Totally Disagree (0%) Totally Agree (100%)

 (Place a mark on the scale above)

9. In situations of doubt as to whether a disease might be of bacterial etiology, it is preferable to prescribe an antibiotic. Totally Disagree (0%) Totally Agree (100%)

 (Place a mark on the scale above)

10. I frequently prescribe antibiotics because patients insist on it. Totally Disagree (0%) Totally Agree (100%)

 (Place a mark on the scale above)

11. I sometimes prescribe antibiotics so that patients continue to trust me. Totally Disagree (0%) Totally Agree (100%)

 (Place a mark on the scale above)

12. I sometimes prescribe antibiotics, even when I know that they are not indicated because I do not have the time to explain to the patient the reason why they are not called for. Totally Disagree (0%) Totally Agree (100%)

 (Place a mark on the scale above)

13. If a patient feels that he/she needs antibiotics, he/she will manage to obtain them at the pharmacy without a prescription, even when they have not been prescribed. Totally Disagree (0%) Totally Agree (100%)

 (Place a mark on the scale above)

14. Two of the main causes of the appearance of antibiotic resistance are patient self-medication and antibiotic misuse. Totally Disagree (0%) Totally Agree (100%)

 (Place a mark on the scale above)

15. Dispensing antibiotics without a prescription should be more closely controlled. Totally Disagree (0%) Totally Agree (100%)

 (Place a mark on the scale above)


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Figure J3. Provider questionnaire via REDCap page 2 of 4.

Appendix J

Provider REDCap Questionnaire

Confidential Page 3 of 4

<p>16. In a primary-care context, amoxicillin is useful for treating most respiratory infections.</p>	<p>Totally Disagree (0%)</p> <p>-----</p> <p>(Place a mark on the scale above)</p>	<p>Totally Agree (100%)</p> <p>-----</p>
<p>17. The phenomenon of resistance to antibiotics is mainly a problem in hospital settings.</p>	<p>Totally Disagree (0%)</p> <p>-----</p> <p>(Place a mark on the scale above)</p>	<p>Totally Agree (100%)</p> <p>-----</p>
<p>18. Antibiotic resistance is an important Public Health problem NATIONALLY.</p>	<p>Totally Disagree (0%)</p> <p>-----</p> <p>(Place a mark on the scale above)</p>	<p>Totally Agree (100%)</p> <p>-----</p>
<p>19. Antibiotics are overused in OUR SETTING.</p>	<p>Totally Disagree (0%)</p> <p>-----</p> <p>(Place a mark on the scale above)</p>	<p>Totally Agree (100%)</p> <p>-----</p>
<p>20. Antibiotics are overused NATIONALLY.</p>	<p>Totally Disagree (0%)</p> <p>-----</p> <p>(Place a mark on the scale above)</p>	<p>Totally Agree (100%)</p> <p>-----</p>

IN THE TREATMENT OF RESPIRATORY TRACT INFECTIONS, HOW WOULD YOU RATE THE USEFULNESS OF EACH OF THE SOURCES OF KNOWLEDGE?

<p>Clinical practice guidelines.</p>	<p>Totally Disagree (0%)</p> <p>-----</p> <p>(Place a mark on the scale above)</p>	<p>Totally Agree (100%)</p> <p>-----</p>
<p>Documentation furnished by the Pharmaceutical Industry.</p>	<p>Totally Disagree (0%)</p> <p>-----</p> <p>(Place a mark on the scale above)</p>	<p>Totally Agree (100%)</p> <p>-----</p>
<p>Courses held by the Pharmaceutical Industry</p>	<p>Totally Disagree (0%)</p> <p>-----</p> <p>(Place a mark on the scale above)</p>	<p>Totally Agree (100%)</p> <p>-----</p>
<p>Information furnished by Medical Information Officers.</p>	<p>Totally Disagree (0%)</p> <p>-----</p> <p>(Place a mark on the scale above)</p>	<p>Totally Agree (100%)</p> <p>-----</p>
<p>Previous clinical experience.</p>	<p>Totally Disagree (0%)</p> <p>-----</p> <p>(Place a mark on the scale above)</p>	<p>Totally Agree (100%)</p> <p>-----</p>
<p>Continuing Education Courses.</p>	<p>Totally Disagree (0%)</p> <p>-----</p> <p>(Place a mark on the scale above)</p>	<p>Totally Agree (100%)</p> <p>-----</p>
<p>Others, e.g., contribution of specialists (microbiologists, infectious disease specialists, etc.).</p>	<p>Totally Disagree (0%)</p> <p>-----</p> <p>(Place a mark on the scale above)</p>	<p>Totally Agree (100%)</p> <p>-----</p>

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Figure J4. Provider questionnaire via REDCap page 3 of 4.

Appendix J

Provider REDCap Questionnaire

Confidential Page 4 of 4

Contribution of peers (of the same specialization). Totally Disagree (0%) Totally Agree (100%)

(Place a mark on the scale above)

Data collected via the Internet. Totally Disagree (0%) Totally Agree (100%)

(Place a mark on the scale above)

SOME QUESTIONS ABOUT SOCIO-DEMOGRAPHIC AND PROFESSIONAL DATA AND ABOUT YOUR CLINICAL PRACTICE

How old are you? _____

Gender: Female
 Male

What is your medical specialization? Nurse Practitioner
 Physician

How many years have you been practicing? _____

How many years have you worked in urgent care? _____

Approximately, what is the number of patients you see per day? _____

Approximately, what is the number of patients seen per day at your urgent care facility? _____

Approximately, how much time (minutes) do you need to attend to one patient? _____

DO YOU HAVE ANY SUGGESTIONS OR COMMENTS ABOUT ANTIBIOTIC USE AND RESISTANCE?

(Optional) _____


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Figure J5. Provider questionnaire via REDCap page 4 of 4.

Appendix K

1-Hour ROAR Presentation

I. Objectives

1. To promote antibiotic prescribing practice per guidelines to improve quality care.
2. To provide healthcare providers with literature and statistics related to antibiotic resistance and overuse.
3. To provide healthcare providers education regarding acute respiratory infections and treatment.
4. To provide healthcare providers with feedback regarding current antibiotic prescribing rates and beliefs and knowledge regarding antibiotic resistance and use.

II. Goals

1. To decrease healthcare provider antibiotic prescribing for acute respiratory infections.
2. To increase healthcare provider awareness of antibiotic resistance and stewardship.
3. To increase healthcare provider patient communication and education.

III. Problem and Significance

1. Antibiotic resistance

a) What is it?

- Antibiotic resistance is a phenomenon that happens when an antibiotic loses the ability to successfully eradicate bacterial growth (Institute of Medicine [IOM], 2010).

b) When was it first detected?

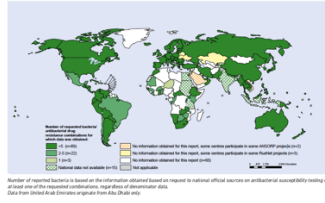
- Identified as early as 1940 with penicillin-R *Staphylococcus* prior to the widespread use of penicillin in 1943 (Centers for Disease Control and Prevention [CDC], 2013).

c) How is it caused?

- The emergence of drug-resistant bacteria can be attributed to the evolution of microbes but also by inappropriate use of antibiotics to treat non-bacterial infections (Agency for Healthcare Research and Quality [AHRQ], 2014; CDC, 2013).

d) Antibiotic resistance is a global healthcare crisis

- According to the literature, most US healthcare providers are aware of antibiotic resistance (Abbo et al., 2011; Abbo, Smith, Pereyra, Wyckoff, & Hooton, 2012; McCullough, Rathbone, Parekh, Hoffmann, & Mar, 2015; Rezal et al., 2015) in which 98% deem it to be serious (McCullough et al., 2015). Studies show 92% to 94% of US healthcare providers believe antibiotic resistance is a national problem (Abbo et al., 2011, 2012; McCullough et al., 2015) yet only 89% believe it is a global problem (McCullough et al., 2015).



Source: World Health Organization (2014)

- This map depicts resistance on 9 selected bacteria-antibacterial drug-resistance combinations with the darkest green showing >5. As you can see, the US along with Canada, eastern portion of Brazil, Europe, Russia, China, Australia and scattered portions of Africa all have >5 bacteria reported. Data was not available for the portions on the map that are either white or have a diamond pattern.



Source: Center for Disease Dynamics, Economics & Policy (2016)

- These maps show resistance of specific organisms to a specific antimicrobial agent in 2012. The darker the blue, the higher the resistance. The left shows *E. coli* resistance to fluoroquinolones, the top right showing staph aureus resistance to oxacillin and the bottom right showing staph aureus resistance to fluoroquinolones.
- These organisms were chosen because these are common organisms that the urgent care centers come across. MO is in the West North Central Region. The left shows *E. coli* resistance to fluoroquinolones with the West North Central at 18% resistant, the top right showing staph aureus resistance to oxacillin with West North Central at 43% resistant and the bottom right showing staph aureus resistance to fluoroquinolones with West North Central at 43% resistant.

2. Overuse of antibiotics

Approximately 50% of antibiotics prescribed are not necessary (AHRQ, 2014; CDC, 2013), nevertheless antibiotics are one of the most often prescribed outpatient medications in the United States (Gerber et al., 2013; Lee et al., 2014).

a) Increased healthcare costs.

In the United States, yearly antibiotic resistant infections lead to more than 8 million additional hospital days and cost the healthcare system an excess of \$20 billion a year and \$35 billion a year in lost wages (CDC, 2011).

- Between 2000 and 2010, utilization of antibiotic drugs increased by 36% in which the United States was the third largest consumer with an estimated 9.2% of global consumption (Van Boeckel et al., 2014).

- Lee et al. (2014) revealed from 2000 to 2010 there was an estimated 1.4 billion outpatient antibiotics prescribed in the United States.
- In 2011, there was an estimated 8 million outpatient and emergency department (ED) visits for acute respiratory infections (ARIs) with the number of antibiotic prescriptions totaling almost 9.3 million (CDC, 2014a, b, c, d).

b) Increased adverse patient events.

In the United States, there are over 2 million illnesses and at least 23,000 deaths yearly as a direct result of antibiotic-resistant infections (CDC, 2013).



(<http://www.cdc.gov/getsmart/community/images/materials/ar-deaths.jpg>)

(graphic CDC, 2016)

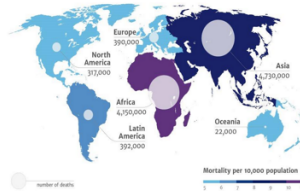
- According to the CDC (2012), adverse drug events cause 700,000 emergency department visits and 120,000 hospitalizations yearly resulting in an extra \$3.5 billion in extra costs.
- Adverse drug events related to antibiotic use include: interactions with other drugs; side effects that commonly cause rash, nausea, vomiting, abdominal pain, headaches, etc.; allergic or hypersensitivity reactions e.g., Stevens Johnson Syndrome and Toxic Epidermal Necrolysis; and change in normal body flora resulting in either infections such as oral or vaginal yeast infections and antibiotic associated diarrhea *Clostridium difficile* (Drugs.com, 2013).
- Over 140,000 (19%) of the emergency department visits are due to reactions to antibiotics yearly and almost 4 out of 5 (79%) antibiotic related emergency department visits are due to allergic reactions (CDC, 2014e).

c) Top three urgent antibiotic resistance threats in the United States

The CDC has identified 18 antibiotic resistance threats in the United States (US) prioritizing them as urgent, serious, or concerning and suggests that aggressive action is necessary now to prevent current antibiotic resistance spread and the development of new resistance (CDC, 2014f).

- *Clostridium difficile* (*C. difficile*) resulting in hospitalization of 250,000 people with 14,000 deaths yearly and \$1 billion excess medical costs.
- Carbapenem-resistant *Enterobacteriaceae* (CRE) causing 9,000 healthcare associated infections yearly in which half of those with blood stream infections result in death.
- Drug-resistant *Neisseria gonorrhoeae* cases as high as 246,000 of the 820,000 yearly cases (CDC, 2014f).

d) Deaths attributable to antimicrobial resistance every year by 2050

**Source: Review on Antimicrobial Resistance (2014)**

- Currently antimicrobial resistance results in 700,000 deaths/year worldwide. This map shows with a continued rise in resistance, by 2050 AMR would lead to 10 million deaths/year worldwide – costing the world up to 100 trillion USD. The variation in deaths linked to how heavily the countries use antibiotics.

3. Factors contributing to antibiotic overuse

Studies have shown providers were found to have inadequate knowledge about antibiotic prescribing (Abbo et al., 2011, 2012; Rezal et al., 2015), underestimate antibiotic resistance (Rezal et al., 2015) and some feel antibiotic resistance is a lower priority than their immediate patient needs (McCullough et al., 2015). A literature review shows inappropriate prescribing of antibiotics has been attributed to several indirect, extrinsic and intrinsic factors.

a) Indirect factors.

- Provider uncertainty of diagnosis (Rezal et al., 2015; Rodrigues, Roque, Falcao, Figueiras, & Herdeiro, 2012).
- Communication skills (Rodrigues et al., 2015).

b) Extrinsic factors.

- Patient signs/symptoms (Lopez-Vazquez, Vazquez-Lago, & Figueiras, 2011; Rodrigues et al., 2012).
- Serious or critically ill patient (Abbo et al., 2011, 2012; Rezal et al., 2015).
- Decreased patient visit time (Rodrigues et al., 2012; Sanchez, Roberts, Albert, Johnson, & Hicks, 2014).

c) Intrinsic factors.

- Fear of missing infection (Abbo et al., 2011, 2012).
- Fear of patient complication (Lopez-Vazquez et al., 2011; Rodrigues et al., 2012; Sanchez et al., 2014).
- Provider complacency or perception that patient wants antibiotics (Lopez-Vazquez et al., 2011; Rezal et al., 2015; Rodrigues et al., 2012; Sanchez et al., 2014).

IV. Antibiotic Prescribing

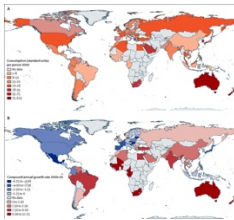
1. Global use of antibiotics



Source: Center for Disease Dynamics, Economics & Policy (2016)

- This map shows use of all antibiotics in 2010 across the world.
- The light blue colors with the least use increasing into darker blue colors as increased use is noted.
- The highest use found in South Africa with 37K units per 1000 population; the US found in mid-range use of 22K units per 1000 population; and the lowest use being in Indonesia with 3K units per 1000 population.

2. Global antibiotic consumption



- Between 2000-2010 antibiotic consumption increased by 36% and in 2010 the highest consumer of antibiotics was India (1st), China (2nd) and USA (3rd).
- The top map (A) shows consumption of antibiotics in 2010 expressed in standard units (i.e., pill, capsule, or ampoule) per person – the lighter red color representing less consumption with color increasing in darkness representing increasing consumption.
- The bottom map (B) shows compound annual growth rate of antibiotic drug consumption between 2000 and 2010 – the blue colors showing a decrease and the red colors showing an increase.
- These maps are showing that in 2010 the US antibiotic consumption was 55-75 standard units per person, from 2000 to 2010 there was a decrease of 2.5 to 4.0 in antibiotic consumption.

Van Boeckel et al (2014) *The Lancet Infectious Diseases* 2014 14, 742-750 DOI: (10.1016/S1473-3099(14)70780-7)

3. United States Outpatient Antibiotic Prescribing Trends/Patterns

2013 with 268.6 million antibiotics prescribed = 849 prescriptions per 1000 persons (CDC, 2015a)

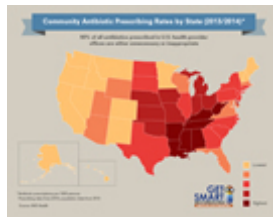
1. Most common category

- Penicillin: 60.8 million
- Macrolides: 51.0 million – interestingly macrolides have been associated with bacterial resistance (Suda et al., 2014).

2. Most common agent

- Amoxicillin: 53.3 million
- Azithromycin: 47.2 million– azithromycin is thought to be overprescribed due to it being conveniently packaged and its once a day short duration of treatment (Suda et al. 2014).

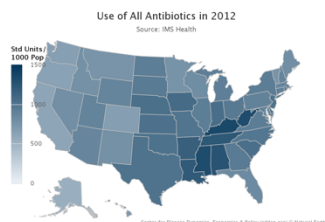
3. Provider associated with prescribing most antibiotic
 - Primary Care: 121.7 million
 - Nurse Practitioners & Physician Assistants: 48.4 million
 - Emergency Medicine: 14.3 million
4. Patient gender
 - Female: 162.8 million
 - Male: 104.8 million
5. Geographical regions – the geographic variation in US prescribing rates is difficult to make clear because the national antibiotic prescribing polices and treatment guidelines (Hicks et al., 2015)
 - South: 111.7 million
 - Midwest: 61.0 million
 - Northeast: 49.0 million
 - West: 47.0 million
6. Season
 - The season most associated with increased antibiotic prescribing are the winter months' when bacterial and especially viral illnesses are common.
 - The winter months average 24.5% more antibiotics than summer
 - Between 2006-2010 the winter months had 1.34 billion antibiotics prescribed (Suda et al., 2014)



(<http://www.cdc.gov/getsmart/community/images/usmap.jpg>)

(graphic CDC, 2016)

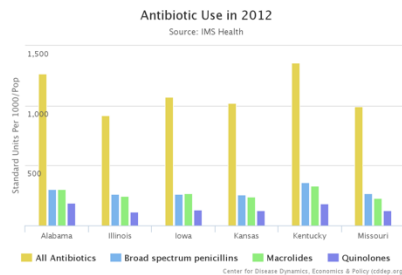
4. Antibiotic use in the USA



Source: Center for Disease Dynamics, Economics & Policy (2016)

- This map shows US use of all antibiotics in 2012.
- MO used 995 standard units per 1000 population whereas the least used was in Alaska at 553 standard units and the most used was in Kentucky at 1357 standard units.

5. Antibiotic use around the state of MO



Source: Center for Disease Dynamics, Economics & Policy (2016)

- This chart shows a graph of antibiotic use in 2012 of MO and surrounding states.
 - The tall yellow line representing all antibiotic use, blue is broad spectrum PCN, green is macrolides and purple is quinolones.
 - MO shows comparable use of surrounding states, other than that of Kentucky and Alabama with higher use.
6. Provide feedback and discuss provider chart audit obtained
- A retrospective chart review of 16 physicians and 18 NPs was done for 6 of the 8 Urgent Care Clinics.
 - Oct, Nov, and Dec 2015 150 charts were reviewed (99 Female patients and 51 Male patients; 73 patients seen by NPs and 77 patients seen by Physicians). This chart audit revealed a total of 79 antibiotic prescriptions for acute respiratory infection resulting in a 53% antibiotic prescribing rate.
 - a) Most common category
 - Macrolides: 39
 - Penicillin: 29
 - b) Most common agent
 - Azithromycin: 38
 - Amoxicillin: 21
 - c) Provider associated with prescribing most antibiotic
 - Physicians: 49
 - Nurse Practitioners: 30
 - d) Patient gender
 - Female: 52 with most at Winghaven (16)
 - Male: 27 with most at Chesterfield (6) and Winghaven (6)
 - e) Center
 - Winghaven: 22
 - Chesterfield: 21
 - f) Diagnosis
 - Bronchitis: 33
 - URI: 25
 - Pharyngitis/laryngitis: 21

When compared to the 2013 US data, the top 2 categories and ages were the same except macrolides were prescribe more than penicillins. Females received more

antibiotics than males. Yet physicians prescribed more antibiotics than nurse practitioners.

V. Acute Respiratory Infection Facts

1. Number of patients seen yearly for acute respiratory infections.
 - Lee et al. (2014) revealed from 2000 to 2010 there were 3.1 billion outpatient ARI visits in the United States.
 - In 2011, there was an estimated 8 million outpatient and emergency department (ED) visits for ARIs (CDC, 2014a, b, c, d).
2. Time frame of viruses.
 - Adults get 2-4 times/year (Schellack et al. 2014)
 - Children get 6-8 times/year (Havens & Schwartz, 2016)
 - Viruses typically resolve with symptomatic treatment within 7-10 days (Schellack et al, 2014)
3. Antibiotics are not for viruses.
 - Per definition, antibiotics are a type of antimicrobial drug used in the treatment of bacterial infections.
 - Antibiotics are not for viruses!!!
4. Sputum color – No benefit from antibiotic treatment.



(Cleveland Clinic, 2014)

- a) 1952 analysis of green sputum (Robertson, 1952)
 - Wanted to know why is sputum green color in patients diagnosed with bronchiectasis – is it due to bacterial involvement?
 - Spectrophotometric analysis revealed green color due to failure to excrete verdoperoxidase (green color enzyme from white blood cells) and is due to the stagnation (not coughing much) of the purulent sputum.
 - He found green color sputum is rarely due to bacterial infection.
- b) 2009 (Altiner et al., 2009)
 - Examined 241 sputum samples of acute cough of 1 to 21-day duration (mean 8 days)
 - Only 29 (12%) of the samples revealed bacterial infection
 - They found color of sputum to be a weak diagnostic predictor of bacteria
 - They conclude that in those without underlying chronic lung disease, sputum color does not imply need for antibiotic
- c) 1976 study (Scott & West, 1976)
 - 207 adults with productive cough up to 1-week duration
 - With treatment doxycycline or placebo x 10 days

- They found otherwise healthy adults get better as quickly without antibiotic
- d) 2011 study (Butler et al., 2011)
- 2,419 \geq 18 year olds with cough as main symptom \leq 28 days
 - With treatment antibiotic or placebo
 - Patients with discolored sputum showed increase in antibiotic prescribing
 - Patients with COPD (67.4%), asthma (57.9%), $>$ 65 years (54.5%) had antibiotics prescribed
 - They conclude that symptom resolution or any benefits are not associated with antibiotic treatment in patients with discolored sputum
- e) 2013 study (Llor et al., 2013)
- 345 18 to 70-year-old patients with acute bronchitis $<$ 1-week duration and purulent sputum
 - With treatment ibuprofen, Augmentin or placebo x 10 days
 - Number of days with frequent cough: ibuprofen 9d, Augmentin 11 days, placebo 11 days
 - Duration of symptoms: ibuprofen 10 days, placebo 13 days
 - They conclude that antibiotics are not associated with likelihood of cough resolution or shorten duration of cough
5. Recent study and National Guidelines
- A study by Fleming-Dutra and colleagues (2016) analyzed antibiotic prescribing among US ambulatory care visits 2010-2011 and found 154 million prescriptions for antibiotics were written. Out of a sample of 184 thousand visits, 12.6% resulted in an antibiotic prescription, with an estimated 506 antibiotic prescriptions per 1000 population annually and acute respiratory infections associated with 221 antibiotic prescriptions per 1000 population. The top 3 diagnoses associated with antibiotics were sinusitis (56 Rx/1000 pop), suppurative otitis media (47 Rx/1000 pop) and pharyngitis (43 Rx/1000 pop).
 - National guidelines state that patients with bronchiolitis, viral upper respiratory tract infections, asthma and allergy, influenza, viral pneumonia, non-suppurative otitis media and bronchitis (excluding visits with diagnosis of chronic bronchitis, emphysema, or chronic obstructive pulmonary disease) should not receive antibiotics (Fleming-Dutra, et al. 2016)
6. Common Cold and Acute Purulent Rhinitis.
- a) Cochrane review (Kenealy, 2013)
- Chart review from 1950 to 2002 found 11 Randomized Control Trial studies (6 colds and 5 purulent rhinitis)
 - Studies compared antibiotic treatment against placebo
 - They found no benefit from antibiotic with cure or persistence of symptoms
 - Also, there were greater side effects with using antibiotics in adults
- b) URI – symptoms may last 10-14 days (CDC, 2015b) with mild cough persisting for 2-3 weeks (Snellman et al., 2013)

- c) Sinusitis – 9 of 10 cases in adults and 5-7 of 10 cases in children are viral (CDC, 2015c)

7. Pharyngitis.

- a) Cochrane review (Spinks, Glasziou & Del Mar, 2013)
 - Chart review from 1950 to 2003 (7 studies 1996 to 2003) found 27 Randomized Control Trial studies
 - Studies compared antibiotic treatment against placebo
 - They found sore throat and fever were reduced by ½ with antibiotic; with only a shortened duration of symptoms by 16 hours
 - They also found with placebo: sore throat disappeared after 3 days (40%), fever disappeared after 3 days (85%), and 82% were symptom free by 1 week
- b) Caused by virus in 80-90% of cases (Salkind & Wright, 2008)
- c) If you have a negative rapid strep, please do not prescribe antibiotics
- d) Viral causes of pharyngitis (Alcaide & Bisno, 2007)

Viral causes		
Coxsackie	Epstein Barr	Cytomegalovirus
HIV	Influenza	Rhinovirus
Coronavirus	Adenovirus	Herpes

- e) Pharyngitis in 10-30% is caused by Strep A with only 10-15% cases in adults (Llor, Madurell, Balagué-Corbella, Gómez, & Cots, 2011)
- f) Bacterial of causes of pharyngitis (Alcaide & Bisno, 2007)

Bacterial causes		
Strep A, C, G	Gonorrhea	Chlamydia
Diphtheria	Pneumonia	Enterocolitis
Plague	Secondary Syphilis	Tularemia

8. Bronchitis.

- a) Cochrane review (Smith, Fahey, Smucny, & Becker, 2014)
 - Chart review from 1970 to 2013 found 17 Randomized Control Trial studies
 - Studies compared antibiotic treatment against placebo or no treatment
 - They excluded patients with COPD/chronic bronchitis
 - They found no benefit from antibiotic with cure
 - They also discovered that those who received antibiotic only recovered ½ day sooner (over 8-10-day period) in decreasing cough
- b) 90% are non-bacterial (CDC, 2015d)
- c) Chest x-ray warranted if temp >38 C, respirations >24, pulse >100, adventitious lung sounds (rales, egophony, fremitus) (CDC, 2015d)

VI. Helpful Resources

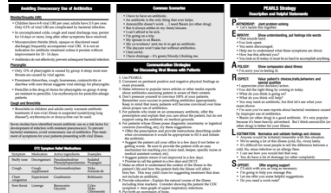
- Guidelines focused on acute respiratory infections have been developed to assist providers in managing illnesses by detailing symptoms and differential diagnoses, reducing unnecessary antibiotic use and improving first line antibiotic use for antibiotic appropriate infections by providing treatment recommendations, and fostering provider-patient communication with tips and comfort measures to convey to patients.

1. Clinical PEARLS.

Developed by Michigan Antibiotic Resistance Reduction Coalition (2004) – This is a 1-page document discussing illness facts, OTC treatments, patient communication strategies by utilizing PEARLS (partnership, empathy, apology, respect, legitimation, and support), and helpful statements to communicate to patients.

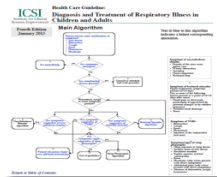
Clinical PEARLS to Avoid Unnecessary use of Antibiotics

Download PEARLS PDF



2. Evidence-based practice guidelines.

This document was done by Snellman et al. (2013) - It has multiple diagnoses in algorithm form with treatment recommendations and provide patient information. This document can be printed and but the online version is easier to use and has interactive links on the algorithm.



Health Care Guideline Diagnosis and Treatment of Respiratory Illness in Children and Adults

3. Alliance Working for Antibiotic Resistance Education (AWARE).

This was developed by the California Medical Association (2016) – These brochures are 2 page guidelines, discuss multiple illnesses, when and when not to treat with antibiotics, pathogens of illnesses

Acute Respiratory Tract Infection Guideline Summary - Adult

Acute Respiratory Tract Infection Guideline Summary - Pediatric



4. CDC.

Developed by the CDC (2015e) – The CDC wants the public to get smart about antibiotics these 2-page patient brochure inform about using antibiotic wisely

Cold or Flu. Antibiotics Don't Work for You



VII. Stewardship

Antibiotic stewardship is an interventional program for healthcare providers to enhance knowledge of antibiotic resistance and promote principles of responsible antibiotic use to preserve antibiotic effectiveness and decrease resistance (CDC, 2014f).

1. Interagency Task Force on Antimicrobial Resistance

- In March 2015, the Interagency Task Force on Antimicrobial Resistance developed the *National Action Plan for Combating Antibiotic-Resistant Bacteria*
- This plan provides a roadmap to detect, prevent, and control antibiotic resistance by guiding activities to improve antimicrobial stewardship with a goal of reducing outpatient inappropriate antibiotic use by 50% by 2020 (The White House, 2015).

2. CDC program.

- In 2003, the CDC devised the Get Smart: Know When Antibiotics Work program to educate healthcare providers and the public about the importance of appropriate antibiotic prescribing.
- Since the initiation of the Get Smart program, The National Ambulatory Medical Care Survey reports that the program has produced a 25% reduction in outpatient antibiotic use for viral infections and 13% reduction in antibiotic prescribing (CDC, 2013).

3. Reducing Outpatient Antibiotic Resistance (ROAR) DNP project.

A review of the literature revealed antibiotic stewardship interventions resulted in 4.2% to 11.6% reduction in antibiotic prescribing (Grover et al., 2013; van der Velden et al., 2012). Since the urgent care centers do not currently have an outpatient antibiotic stewardship program the Reducing Outpatient Antibiotic Resistance project was developed.

The project is a quasi-experimental Theory-based intervention on antibiotic prescribing.

- a) The purpose of the project is to evaluate the effect of an antibiotic stewardship program on urgent care providers' antibiotic prescribing for acute respiratory infections and to assess providers' knowledge and attitude concerning antibiotic use and resistance.
- b) Outcomes to be measured include
 - Provider antibiotic prescribing rates pre- and post-intervention
 - Differences in antibiotic prescription rates of the diverse providers and
 - Provider attitude and knowledge regarding antibiotic prescribing and resistance.

VIII. Patient Communication

1. Strategies. (Hicks, 2010)

- a) Provide specific diagnosis
 - Say "viral URI" or "viral bronchitis"
- b) Offer symptomatic relief therapy
 - Use of ibuprofen/acetaminophen can decrease fever, headaches, body aches to help feel better
 - Give prescription for OTC medicines if feel that patient does not want to leave empty handed
- c) Voice what is seen during exam
 - Ears are not red, bulging or with fluid behind them
 - Lungs are clear (have noted helps a lot with elderly reassurance)
- d) Inform about antibiotic side effects and increased resistance
 - Can give patient brochure from the CDC
 - Discuss information discussed earlier – try saying "Antibiotics are only for bacterial infections. Increased use has led to antibiotic resistance – a global public healthcare crisis that reduces the efficacy of antibiotics to adequately treat bacterial infections"
- e) Advise on what to expect with illness to reassure them
 - Tell them on average how long symptoms might last - I do tell them that everyone's body has different way reacting to infections. I also try to estimate duration of illness in other patients I have seen.
 - Good to let those with bronchitis know that cough can last for a long time (4-6 weeks) so they will not be alarmed
 - Give a plan of action if don't improve or worsen
- f) Reassure the patient
 - Tell them that you understand how bad they feel
 - Give a plan of action if don't improve or worsen

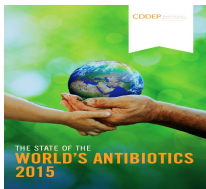
2. Learn how to say "No" and teach, teach, teach. (Chesanow, 2016)

- a) Put no in an explanation
 - Be diplomatic and less confrontational
 - 'You do not need an antibiotic because this is viral and antibiotics do not treat viruses nor will they help you get better'
- b) Open a discussion and explain

- Try to find out why they want antibiotic
- If they say they got one last time, assure that it is viral and symptoms should resolve shortly
- c) Be willing to negotiate
 - Offer explanation of why what they want is incorrect and provide alternative
 - If they have tried OTC treatments say ‘since you’re not feeling better, let’s discuss other options that aren’t antibiotics’
- d) Be a cheerleader
 - Tell them they are doing the correct thing and sometimes resolution of symptoms takes time
- e) Show patient’s empathy and compassion
 - Acknowledge they are sick and let them know you understand their frustration
 - ‘I’m sorry you are sick and feel bad’
 - ‘You look ill; it must be hard to get things done’
- f) Be firm when needed
 - Gently put your foot down
 - ‘I’m sorry, antibiotics are not for viruses’

IX. Conclusion

1. Antibiotic resistance is global public health crisis.
Antibiotic resistance is a global public health crisis reducing the efficacy of antibiotics to adequately treat infections, increasing patient mortality and skyrocketing healthcare costs (CDC, 2013; Center for Disease Dynamics, Economics & Policy, 2015; IOM, 2010; World Health Organization [WHO], 2014).



2. Antibiotics are not for treatment of viruses.
Antibiotics in their own right are beneficial and have a purpose – that of treating bacterial infections to improve health and prevent mortality

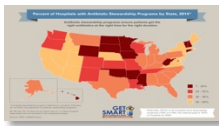


(<http://www.cdc.gov/getsmart/community/images/materials/improve-prescribing.jpg>)
(graphics CDC, 2016)

3. Antibiotic stewardship to decrease antibiotic prescribing.

- Antibiotic stewardship primary goal is better patient care, reducing antibiotic use and saving money are just desirable side effects.
- To preserve antibiotic effectiveness and slow the progression of antibiotic resistance, coordinated interventions involving healthcare providers can be provided through antibiotic stewardship programs (CDC, 2013; Griffith, Postelnick, & Scheetz, 2012).
- The *Reducing Outpatient Antibiotic Resistance (ROAR)* theory-based intervention is an evidence-based DNP project created to reinforce providers' confidence by enhancing knowledge in their ability to manage ARIs without antibiotics.

4.



5. Patient communication and education are the keys.
 - The importance of how treatment recommendations are delivered during a visit for acute respiratory infections help to avoid unwarranted antibiotic prescribing.
 - Communicate with patients utilizing PEARLS (partnership, empathy, apology, respect, legitimation, support) along with the strategies discussed and learn how to say “No”.
 - Don't forget to provide patient handouts explaining antibiotics – when they are not needed and risks involved in use.



(<http://www.cdc.gov/getsmart/community/images/materials/six-facts-graphic.png>)

(graphics CDC, 2016)

X. Cartoons

1. Batman and Robin.



From “Batman on flu season,” by WeKnowMemes, LLC, 2013 (<http://weknowmemes.com/2013/01/batman-on-flu-season/>). Reprinted with permission.

2. Antibiotic Resistance.



From “Antibiotic resistance,” by Nick D. Kim, 2015 (<http://www.lab-initio.com/a.html>). Reprinted with permission.

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Appendix L1

Intervention Material

Best Practices in the Management of Patients with Acute Bronchitis/Cough

Evidence-Based Management of Acute Respiratory Tract Infections
Repeated studies and meta-analyses have demonstrated no significant benefit from antibiotics in otherwise healthy persons. Antibiotic administration is associated with allergic reactions, C. difficile infection and future antibiotic resistance in the treated patient and the community.

Assess for pneumonia
(see reverse side of brochure)

In the absence of pneumonia, consider the following diagnoses for adults with acute cough illness.

Acute Bronchitis
Diagnosis:
• Cough dominant
• +/- rhinorrhea
• No chest/ear symptoms

URI or Rhinovirus/Flu
Diagnosis:
• Cough plus nasal, throat and/or eye symptoms
• No chest/ear symptoms

Influenza During the Season
Diagnosis:
• Cough +/- fever +/- myalgias/fatigue present, prevalence > 50%

Acute Bacterial Sinusitis
• See reverse side of brochure

ANTIBIOTICS NOT NEEDED

See reverse for recommendations on antibiotic therapy.

Reference Articles

Acute Bacterial Sinusitis:

- The American Academy on Otolaryngology-Head and Neck Surgery. Clinical Practice Guideline: Adult Bacterial Sinusitis. *Otolaryngol Head Neck Surg*. January, Supplement 2004;131:145.
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Pharyngitis:

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Supporting Organizations

Alameda Alliance for Health
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Illness	Indications for Antibiotic Treatment	Pathogen	Antimicrobial Therapy	Antibiotics	Guidelines Reviewed
Acute Bacterial Sinusitis	When to Treat with an Antibiotic: Nearly all cases of acute bacterial sinusitis resolve without antibiotics. Antibiotic use should be reserved for moderate symptoms that do not improve after 10 days, or severe symptoms. When to Treat with an Antibiotic: Diagnosis of acute bacterial sinusitis may be made in adults with symptoms of acute rhinosinusitis (nasal obstruction or purulent discharge, facial pressure or pain, fever, or purring) who have any of the two following clinical presentations: • Symptoms lasting > 10 days without clinical improvement. • Severe illness with high fever (>39°C [102.2°F]) and purulent nasal discharge or facial pain for ≥3 consecutive days of the beginning of illness. • Worsening symptoms or signs have onset later, headache or increase in nasal discharge, following typical URI that lasted ≥5 days and was highly improving.	Majority viral pathogens Streptococcus pneumoniae Haemophilus influenzae Moraxella catarrhalis	Not indicated Antibiotic Duration: 10-14 days Failure to respond after 7-10 days: Re-evaluate patient and switch to alternate antibiotic.	1st Line: • Amoxicillin-clavulanate (875 mg/125 mg qd) Alternatives: • Doxycycline (100 mg bid) • Levofloxacin (500 mg qd) • Trimethoprim-sulfamethoxazole (1600/800 mg bid) For a Lactating Woman: • Doxycycline, Respiratory (penicillin) (penicillins, penicillamine, penicillamine)	American Academy of Allergy, Asthma & Immunology (AAAAI) American Academy of Family Physicians (AAFP) American Academy of Otolaryngology - Head and Neck Surgery Arizona College of Physicians (ACP) Centers for Disease Control and Prevention (CDC) Infectious Disease Society of America (IDSA)
Pharyngitis	When to Treat with an Antibiotic: <i>Streptococcus pyogenes</i> Group A (Group A) Strep of acute throat, fever, headache, and tonsillitis or fever. Physical findings include: Fever, tenderness/swollen anterior and posterior pharynx, tender and enlarged anterior cervical lymph nodes, and absence of cough. Confirm diagnosis with throat culture or rapid antigen calculation before using antibiotics. When to Treat with an Antibiotic: <i>Streptococcus pyogenes</i> Group A (Group A) Strep of acute throat, fever, headache, and tonsillitis or fever.	Most pharyngitis cases are viral Streptococcus pyogenes	Group A Strep: Treatment reserved for patients with rapid antigen test positive or throat culture. Antibiotic Duration: 10 days	1st Line: • Penicillin V (500 mg qd) • Amoxicillin (500 mg qd) Alternatives: • Clindamycin For a Lactating Woman: • Clindamycin, Clindamycin, Clindamycin	AAAAI, CDC, IDSA Centers for Disease Control and Prevention (CDC) Infectious Disease Society of America (IDSA)
Rhinovirus/Flu/ Acute Bronchitis	When to Treat with an Antibiotic: <i>Rhinovirus/Flu/ Acute Bronchitis</i> of acute onset with symptoms of acute rhinosinusitis (nasal obstruction or purulent discharge, facial pressure or pain, fever, or purring) who have any of the two following clinical presentations: • Symptoms lasting > 10 days without clinical improvement. • Severe illness with high fever (>39°C [102.2°F]) and purulent nasal discharge or facial pain for ≥3 consecutive days of the beginning of illness. • Worsening symptoms or signs have onset later, headache or increase in nasal discharge, following typical URI that lasted ≥5 days and was highly improving.	Majority viral pathogens Streptococcus pneumoniae Haemophilus influenzae Moraxella catarrhalis	Not indicated	Not indicated	AAAAI, CDC, IDSA
Pertussis	Testing for pertussis: Recommended particularly during outbreaks and according to public health recommendations, particularly those at high risk - day care and healthcare workers. Patients with exposure to high-risk groups, child care workers or family members should be vaccinated and tested if they have symptoms. Vaccination per ACP recommendations is highly encouraged to prevent outbreaks. All pregnant women should be vaccinated during every pregnancy.	Bordetella pertussis	Treatment is required for all cases and close contacts or as directed by health officer	Azithromycin* 2nd line: TMP/SMX	CDC
Nonspecific URI	When to Treat with an Antibiotic: <i>Rhinovirus/Flu/ Acute Bronchitis</i> of acute onset with symptoms of acute rhinosinusitis (nasal obstruction or purulent discharge, facial pressure or pain, fever, or purring) who have any of the two following clinical presentations: • Symptoms lasting > 10 days without clinical improvement. • Severe illness with high fever (>39°C [102.2°F]) and purulent nasal discharge or facial pain for ≥3 consecutive days of the beginning of illness. • Worsening symptoms or signs have onset later, headache or increase in nasal discharge, following typical URI that lasted ≥5 days and was highly improving.	Majority viral pathogens Streptococcus pneumoniae Haemophilus influenzae Moraxella catarrhalis	Not indicated	Not indicated	AAAAI, CDC, IDSA
Outpatient (Outpatient) Acquired Pneumonia	When to Treat with an Antibiotic: <i>Outpatient (Outpatient) Acquired Pneumonia</i> of acute onset with symptoms of acute rhinosinusitis (nasal obstruction or purulent discharge, facial pressure or pain, fever, or purring) who have any of the two following clinical presentations: • Symptoms lasting > 10 days without clinical improvement. • Severe illness with high fever (>39°C [102.2°F]) and purulent nasal discharge or facial pain for ≥3 consecutive days of the beginning of illness. • Worsening symptoms or signs have onset later, headache or increase in nasal discharge, following typical URI that lasted ≥5 days and was highly improving.	Streptococcus pneumoniae Haemophilus influenzae Moraxella catarrhalis Chlamydia pneumoniae	Empiric Therapy: Healthy with recent antibiotic use and features "Mild/Moderate", consider doxycycline. Presence of one or multiple antibiotic use within 7 months. Respiratory symptoms (cough plus sputum) or symptoms as well as chest pain in the presence of: • Chest pain • Cough • Fever • Shortness of breath • Pleuritic chest pain • Hemoptysis • Weight loss • Night sweats • Anorexia • Fatigue • Headache • Myalgias • Arthralgias • Diarrhea • Nausea • Vomiting • Abdominal pain • Urinary symptoms • Rash • Conjunctivitis • Sinusitis • Otitis media • Tinnitus • Hearing loss • Vision changes • Taste changes • Smell changes • Hearing loss • Vision changes • Taste changes • Smell changes	Unavoidable without antibiotic use: • Macrolide (erythromycin or clarithromycin)* • Tetracycline (doxycycline, minocycline) With antibiotic use: 1st Line: • Amoxicillin-clavulanate (875 mg/125 mg qd) Alternatives: • Doxycycline (100 mg bid) • Levofloxacin (500 mg qd) • Trimethoprim-sulfamethoxazole (1600/800 mg bid) For a Lactating Woman: • Doxycycline, Respiratory (penicillin) (penicillins, penicillamine, penicillamine)	Infectious Disease Society of America / American Thoracic Society (IDSA/ATS) ESQ
Cavitary and Abscesses	Cavitary and Abscesses: Abscesses are often secondary to Strep - including MRSA. The treatment is primarily drainage and this is required for large abscesses. If surrounding cellulitis, treatment should be broadened to cover MRSA. Culture should be obtained.	Streptococcus pneumoniae Haemophilus influenzae Moraxella catarrhalis Staphylococcus aureus Pseudomonas aeruginosa	Indicated Incision and drainage If high-level resistant cellulitis, oral antibiotic	• Cloxacillin, Clindamycin, Dicloxacillin For Penicillin Allergy: Clindamycin patient should also use other appropriate antibiotic, or TMP/SMX in the absence.	ESIA

*Macrolides and quinolones cause QT prolongation and have an increased risk of cardiac death.
This guideline summary is intended for physicians and healthcare professionals to consider in managing the care of their patients for acute respiratory tract infections. While the summary describes recommended courses of intervention, it is not intended as a substitute for the advice of a physician or other knowledgeable healthcare professional. These guidelines represent best clinical practice at the time of publication, but practice standards may change as more knowledge is gained.

Figure L1: Guidelines for common acute respiratory infections for adults. Reprinted from California Medical Association Foundation: Aware, by California Medical Association, 2016, Retrieved June 27, 2016, from <http://www.thecmafoundation.org/Programs/AWARE>. Reprinted with permission.

Appendix L1

Intervention Material

Best Practices in the Management of Patients with Pharyngitis

Clinician efforts to prescribe appropriately and to educate young patients and their parents/caregivers about antibiotics continue to play a vital role in decreasing resistance levels. Physicians must be able to better spot but also not overlook that sore throat is usually caused by a virus, will not resolve with antibiotics, and that their medications have the potential to cause more harm than good.

Confirm a Streptococcal Cause of Pharyngitis BEFORE Prescribing Antibiotics.

Opt for a narrow-spectrum antibiotic whenever possible for strep pharyngitis.

- Penicillin V (500 mg) or amoxicillin
- For 10-day therapy, use a combination of penicillin V and amoxicillin; otherwise, amoxicillin or amoxicillin-clavulanate.

Educate, Advise and Assist Patients and Parents/Caregivers.

What causes a throat sore? Getting a sore throat is a common condition and can be caused by many different things, including viruses and bacteria. Most sore throats are caused by viruses and do not need antibiotics. However, some sore throats are caused by bacteria and may need antibiotics. It is important to see a doctor if you have a sore throat that lasts more than a week, is very painful, or if you have difficulty swallowing or breathing. Your doctor will examine your throat and may take a sample of your throat to check for bacteria. If you have a bacterial sore throat, your doctor will prescribe antibiotics. It is important to take antibiotics exactly as prescribed and to finish the course of antibiotics. Do not stop taking antibiotics when you feel better, as this can lead to antibiotic resistance. Your doctor will also advise you on how to care for your sore throat, such as drinking plenty of fluids and using lozenges or gargles.

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3. World J. et al. Clinical Practice Guideline for the Diagnosis and Management of Acute Otitis Media in Children Aged 1 to 18 Years. Pediatrics 2013;132:e1072-1080.
4. O'Brien K, et al. Acute Otitis Media - Principles of Pediatric Use of Antibiotics. Pediatrics 1998;101:1747-1751.
5. Chouk et al. CDC Clinical Practice Guideline for Acute Bacterial Pharyngitis in Outpatient and Ambulatory Care Settings. Pediatrics 2012;130:e147-152.
6. DeWitt G, et al. Acute bacterial sinusitis in children. Pediatr Ann 2013;38:429-437.

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5. Chouk et al. CDC Clinical Practice Guideline for Acute Bacterial Pharyngitis in Outpatient and Ambulatory Care Settings. Pediatrics 2012;130:e147-152.
6. DeWitt G, et al. Acute bacterial sinusitis in children. Pediatr Ann 2013;38:429-437.

Pharyngitis:

1. Hooper, et al. Clinical Practice Guideline for the Diagnosis and Management of Acute Bacterial Rhinosinusitis. Otolaryngol Head Neck Surg 2004;130:141-45.
2. Garber, et al. Practice Guideline for the Diagnosis and Treatment of Acute Bacterial Rhinosinusitis. Pediatrics 2010;125:1103-1110.
3. World J. et al. Clinical Practice Guideline for the Diagnosis and Management of Acute Otitis Media in Children Aged 1 to 18 Years. Pediatrics 2013;132:e1072-1080.
4. O'Brien K, et al. Acute Otitis Media - Principles of Pediatric Use of Antibiotics. Pediatrics 1998;101:1747-1751.
5. Chouk et al. CDC Clinical Practice Guideline for Acute Bacterial Pharyngitis in Outpatient and Ambulatory Care Settings. Pediatrics 2012;130:e147-152.
6. DeWitt G, et al. Acute bacterial sinusitis in children. Pediatr Ann 2013;38:429-437.

Non-specific Cough/Whoop/Bronchitis/Parotitis:

1. O'Brien K, et al. Clinical Practice Guideline for the Diagnosis and Management of Acute Bacterial Rhinosinusitis. Pediatrics 2010;125:1103-1110.
2. Centers for Disease Control and Prevention. Recommended antimicrobial agents for the treatment and prophylaxis of pertussis: 2005 CDC guidelines. MMWR 2005;54:161-166.

Bronchiolitis/Non-specific URI:

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3. Hooper, et al. Clinical Practice Guideline for the Diagnosis and Management of Acute Bacterial Rhinosinusitis. Otolaryngol Head Neck Surg 2004;130:141-45.
4. Hooper, et al. Clinical Practice Guideline for the Diagnosis and Management of Acute Bacterial Rhinosinusitis. Otolaryngol Head Neck Surg 2004;130:141-45.

Cellulitis and Abscesses:

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3. World J. et al. Clinical Practice Guideline for the Diagnosis and Management of Acute Otitis Media in Children Aged 1 to 18 Years. Pediatrics 2013;132:e1072-1080.
4. Hooper, et al. Clinical Practice Guideline for the Diagnosis and Management of Acute Bacterial Rhinosinusitis. Otolaryngol Head Neck Surg 2004;130:141-45.

Supporting Organizations

- American Alliance for Health
- Health Plan of San Joaquin
- Albion Blue Cross
- Island Empire Health Plan
- California
- California
- California Health Plan
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Issue	Indications for Antibiotic Treatment	Pathogen	Antimicrobial Therapy	Antibiotic	Guidelines
Otitis Media	<p>When NOT to treat with an Antibiotic: Otitis Media with Effusion (OME) without concurrent acute otitis media (AOM).</p> <p>When to treat with an Antibiotic: Acute Otitis Media (AOM)</p> <ol style="list-style-type: none"> 1. Moderate to severe bulging of the tympanic membrane (TM) or new onset of otitis not due to acute OME. 2. Moderate to severe bulging of the TM with moderate to severe otitis media (OM) or moderate to severe otitis media (OM) with moderate to severe otitis media (OM). 3. Signs or symptoms of middle ear infection as indicated by other criteria. 4. Signs or symptoms of middle ear infection as indicated by other criteria. 5. Signs or symptoms of middle ear infection as indicated by other criteria. <p>Note: Clinicians should not diagnose AOM in children who do not have middle ear effusion.</p>	Streptococcus pneumoniae Haemophilus influenzae Moraxella catarrhalis	<p>Simple AOM: Penicillin V or amoxicillin (20 mg/kg/d in 2 divided doses) for 10 days or amoxicillin-clavulanate (20 mg/kg/d in 2 divided doses) for 10 days.</p> <p>Severe AOM: Amoxicillin-clavulanate (20 mg/kg/d in 2 divided doses) for 10 days or ceftriaxone (10 mg/kg/d in 1 divided dose) for 7 days.</p> <p>Resistant AOM: Ceftriaxone (10 mg/kg/d in 1 divided dose) for 7 days or cefepime (120 mg/kg/d in 3 divided doses) for 7 days.</p>	<p>Length of Oral Therapy:</p> <ul style="list-style-type: none"> • 10 days for simple AOM • 7 days for severe AOM • 7 days for resistant AOM <p>Special Considerations:</p> <ul style="list-style-type: none"> • 2 years of age with middle ear infection, 97% days • 2 years of age with middle ear infection, 97% days 	American Academy of Pediatrics (AAP) American Academy of Pediatrics (AAP) Centers for Disease Control and Prevention (CDC)
Acute Bacterial Sinusitis	<p>When NOT to treat with an Antibiotic: Nasally discharge of acute otitis media (AOM) not improving after 10 days of oral antibiotic therapy.</p> <p>When to treat with an Antibiotic: Clinicians should make a presumptive diagnosis of acute bacterial sinusitis when a child with acute otitis media (AOM) has any of the following:</p> <ol style="list-style-type: none"> 1. Persistent fever, nasal discharge (of any quality) or both lasting 10 days without improvement. 2. Persistent fever, worsening or new onset of nasal discharge, facial pain, or loss after initial improvement. 3. Persistent fever, worsening or new onset of nasal discharge, facial pain, or loss after initial improvement. <p>Note: Clinicians should not diagnose AOM in children who do not have middle ear effusion.</p>	Streptococcus pneumoniae Haemophilus influenzae Moraxella catarrhalis	<p>Amoxicillin: Amoxicillin (20 mg/kg/d in 2 divided doses) for 10 days.</p> <p>Amoxicillin-clavulanate: Amoxicillin-clavulanate (20 mg/kg/d in 2 divided doses) for 10 days.</p> <p>Ceftriaxone: Ceftriaxone (10 mg/kg/d in 1 divided dose) for 7 days.</p> <p>Clindamycin: Clindamycin (10 mg/kg/d in 3 divided doses) for 7 days.</p>	<p>Length of Oral Therapy:</p> <ul style="list-style-type: none"> • 10 days for simple AOM • 7 days for severe AOM • 7 days for resistant AOM <p>Special Considerations:</p> <ul style="list-style-type: none"> • 2 years of age with middle ear infection, 97% days • 2 years of age with middle ear infection, 97% days 	American Academy of Pediatrics (AAP) American Academy of Pediatrics (AAP) Centers for Disease Control and Prevention (CDC)
Pharyngitis	<p>When NOT to treat with an Antibiotic: Most pharyngitis cases are viral in origin. The presence of the following symptoms with Group A Strep and point away from using antibiotics: cough, rhinorrhea, and diarrhea.</p> <p>When to treat with an Antibiotic: Streptococcus pneumoniae (Group A Strep) symptoms and signs are present. Penicillin V or amoxicillin (20 mg/kg/d in 2 divided doses) for 10 days.</p> <p>When to treat with an Antibiotic: Clinicians should make a presumptive diagnosis of acute bacterial sinusitis when a child with acute otitis media (AOM) has any of the following:</p> <ol style="list-style-type: none"> 1. Persistent fever, nasal discharge (of any quality) or both lasting 10 days without improvement. 2. Persistent fever, worsening or new onset of nasal discharge, facial pain, or loss after initial improvement. 3. Persistent fever, worsening or new onset of nasal discharge, facial pain, or loss after initial improvement. 	Streptococcus pneumoniae	<p>Group A Strep: Penicillin V or amoxicillin (20 mg/kg/d in 2 divided doses) for 10 days.</p> <p>Group B Strep: Penicillin V or amoxicillin (20 mg/kg/d in 2 divided doses) for 10 days.</p> <p>Group C Strep: Penicillin V or amoxicillin (20 mg/kg/d in 2 divided doses) for 10 days.</p>	<p>Length of Oral Therapy:</p> <ul style="list-style-type: none"> • 10 days for simple AOM • 7 days for severe AOM • 7 days for resistant AOM <p>Special Considerations:</p> <ul style="list-style-type: none"> • 2 years of age with middle ear infection, 97% days • 2 years of age with middle ear infection, 97% days 	American Academy of Pediatrics (AAP) American Academy of Pediatrics (AAP) Centers for Disease Control and Prevention (CDC)
Non-specific Cough/Whoop/Bronchitis/Parotitis	<p>When NOT to treat with an Antibiotic: Non-specific cough/whoop/bronchitis/parotitis.</p> <p>When to treat with an Antibiotic: Clinicians should make a presumptive diagnosis of acute bacterial sinusitis when a child with acute otitis media (AOM) has any of the following:</p> <ol style="list-style-type: none"> 1. Persistent fever, nasal discharge (of any quality) or both lasting 10 days without improvement. 2. Persistent fever, worsening or new onset of nasal discharge, facial pain, or loss after initial improvement. 3. Persistent fever, worsening or new onset of nasal discharge, facial pain, or loss after initial improvement. 	Streptococcus pneumoniae Haemophilus influenzae Moraxella catarrhalis	<p>Group A Strep: Penicillin V or amoxicillin (20 mg/kg/d in 2 divided doses) for 10 days.</p> <p>Group B Strep: Penicillin V or amoxicillin (20 mg/kg/d in 2 divided doses) for 10 days.</p> <p>Group C Strep: Penicillin V or amoxicillin (20 mg/kg/d in 2 divided doses) for 10 days.</p>	<p>Length of Oral Therapy:</p> <ul style="list-style-type: none"> • 10 days for simple AOM • 7 days for severe AOM • 7 days for resistant AOM <p>Special Considerations:</p> <ul style="list-style-type: none"> • 2 years of age with middle ear infection, 97% days • 2 years of age with middle ear infection, 97% days 	American Academy of Pediatrics (AAP) American Academy of Pediatrics (AAP) Centers for Disease Control and Prevention (CDC)
Bronchiolitis/Non-specific URI	<p>When NOT to treat with an Antibiotic: Most pharyngitis cases are viral in origin. The presence of the following symptoms with Group A Strep and point away from using antibiotics: cough, rhinorrhea, and diarrhea.</p> <p>When to treat with an Antibiotic: Streptococcus pneumoniae (Group A Strep) symptoms and signs are present. Penicillin V or amoxicillin (20 mg/kg/d in 2 divided doses) for 10 days.</p> <p>When to treat with an Antibiotic: Clinicians should make a presumptive diagnosis of acute bacterial sinusitis when a child with acute otitis media (AOM) has any of the following:</p> <ol style="list-style-type: none"> 1. Persistent fever, nasal discharge (of any quality) or both lasting 10 days without improvement. 2. Persistent fever, worsening or new onset of nasal discharge, facial pain, or loss after initial improvement. 3. Persistent fever, worsening or new onset of nasal discharge, facial pain, or loss after initial improvement. 	Streptococcus pneumoniae	<p>Group A Strep: Penicillin V or amoxicillin (20 mg/kg/d in 2 divided doses) for 10 days.</p> <p>Group B Strep: Penicillin V or amoxicillin (20 mg/kg/d in 2 divided doses) for 10 days.</p> <p>Group C Strep: Penicillin V or amoxicillin (20 mg/kg/d in 2 divided doses) for 10 days.</p>	<p>Length of Oral Therapy:</p> <ul style="list-style-type: none"> • 10 days for simple AOM • 7 days for severe AOM • 7 days for resistant AOM <p>Special Considerations:</p> <ul style="list-style-type: none"> • 2 years of age with middle ear infection, 97% days • 2 years of age with middle ear infection, 97% days 	American Academy of Pediatrics (AAP) American Academy of Pediatrics (AAP) Centers for Disease Control and Prevention (CDC)
Cellulitis and Abscesses	<p>Cellulitis: Clinicians should always consider a streptococcal etiology. Treatment can be directed narrowly at streptococci when the following criteria are met: localized, rapidly spreading cellulitis with a well-demarcated border.</p> <p>Abscesses: Clinicians should always consider a streptococcal etiology. Treatment can be directed narrowly at streptococci when the following criteria are met: localized, rapidly spreading cellulitis with a well-demarcated border.</p>	Streptococcus pneumoniae	<p>Group A Strep: Penicillin V or amoxicillin (20 mg/kg/d in 2 divided doses) for 10 days.</p> <p>Group B Strep: Penicillin V or amoxicillin (20 mg/kg/d in 2 divided doses) for 10 days.</p> <p>Group C Strep: Penicillin V or amoxicillin (20 mg/kg/d in 2 divided doses) for 10 days.</p>	<p>Length of Oral Therapy:</p> <ul style="list-style-type: none"> • 10 days for simple AOM • 7 days for severe AOM • 7 days for resistant AOM <p>Special Considerations:</p> <ul style="list-style-type: none"> • 2 years of age with middle ear infection, 97% days • 2 years of age with middle ear infection, 97% days 	American Academy of Pediatrics (AAP) American Academy of Pediatrics (AAP) Centers for Disease Control and Prevention (CDC)

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Appendix L2

Intervention Material


When you feel sick, you want to feel better fast. But antibiotics aren't the answer for every illness. This brochure can help you know when antibiotics work – and when they won't. For more information, talk to your healthcare provider or visit www.cdc.gov/getsmart.

The Risk: Bacteria Become Resistant

What's the harm in taking antibiotics anytime? Using antibiotics when they are not needed causes some bacteria to become resistant to the antibiotic.

These resistant bacteria are stronger and harder to kill. They can stay in your body and can cause severe illnesses that cannot be cured with antibiotics. A cure for resistant bacteria may require stronger treatment – and possibly a stay in the hospital.

To avoid the threat of antibiotic-resistant infections, the Centers for Disease Control and Prevention (CDC) recommends that you avoid taking unnecessary antibiotics.



Antibiotics Aren't Always the Answer

Most illnesses are caused by two kinds of germs: bacteria or viruses. Antibiotics can cure bacterial infections – not viral infections.


Bacteria cause strep throat, some pneumonia and sinus infections. *Antibiotics can work.*

Viruses cause the common cold, most coughs and the flu. *Antibiotics don't work.*

Using antibiotics for a virus:

- Will NOT cure the infection
- Will NOT help you feel better
- Will NOT keep others from catching your illness

Protect Yourself With the Best Care



You should not use antibiotics to treat the common cold or the flu.

If antibiotics are prescribed for you to treat a bacterial infection – such as strep throat – be sure to take all of the medicine. Only using part of the prescription means that only part of the infection has been treated. Not finishing the medicine can cause resistant bacteria to develop.

Talk to Your Healthcare Provider to Learn More

Commonly Asked Questions:

How Do I Know if I Have a Viral or Bacterial Infection?

Ask your healthcare provider and follow his or her advice on what to do about your illness. Remember, colds are caused by viruses and should not be treated with antibiotics.

Won't an Antibiotic Help Me Feel Better Quicker so That I Can Get Back to Work When I Get a Cold or the Flu?

No, antibiotics do nothing to help a viral illness. They will not help you feel better sooner. Ask your healthcare provider what other treatments are available to treat your symptoms.

If Mucus from the Nose Changes from Clear to Yellow or Green — Does This Mean I Need an Antibiotic?

No. Yellow or green mucus does not mean that you have a bacterial infection. It is normal for mucus to get thick and change color during a viral cold.

GET SMART...

- Antibiotics are strong medicines, but they don't cure everything.
- When not used correctly, antibiotics can actually be harmful to your health.
- Antibiotics can cure most bacterial infections. Antibiotics cannot cure viral illnesses.
- Antibiotics kill bacteria – not viruses.
- When you are sick, antibiotics are not always the answer.



USE ANTIBIOTICS WISELY

Talk with your healthcare provider about the right medicines for your health.



Cold or Flu. Antibiotics Don't Work for You.



For more information, see the Centers for Disease Control and Prevention website at: www.cdc.gov/getsmart or call 1-800-CDC-INFO

Figure L2. Brochure for patients. Reprinted from Get smart about antibiotics: Print material for adults, by CDC, 2015, Retrieved June 27, 2016, from

<http://www.cdc.gov/getsmart/community/materials-references/print-materials/adults/index.html>.

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Appendix L3

Intervention Material

<p>Avoiding Unnecessary Use of Antibiotics</p>	<p>Common Scenarios</p>	<p>PEARLS Strategy Description and Helpful Statements</p>																				
<p>Rhinitis/Sinusitis (URI)</p> <ul style="list-style-type: none"> Children have 6-8 viral URI per year; adults have 2-3 per year. Only 0.5% of viral URI are complicated by bacterial infection. In uncomplicated colds, cough and nasal discharge may persist for 14 days or more, long after other symptoms have resolved. Mucopurulent rhinitis (thick, opaque or discolored nasal discharge) frequently accompanies viral URI. It is not an indication for antibiotic treatment unless it persists without improvement for 10 - 14 days. Antibiotics do not effectively prevent subsequent bacterial infection. <p>Pharyngitis</p> <ul style="list-style-type: none"> Only 15% of pharyngitis is caused by group A strep; most sore throats are caused by viral agents. Prominent rhinorrhea, cough, hoarseness, conjunctivitis or diarrhea with sore throat suggests viral etiology for pharyngitis. Penicillin is the drug of choice for pharyngitis; no group A strep are resistant to penicillin. Use erythromycin for penicillin-allergic patients. 	<ul style="list-style-type: none"> I have to have an antibiotic. An antibiotic is the only thing that ever helps. Amoxicillin doesn't work ... I need Biaxin (or other drug) But it always settles in my chest/sinuses. I can't afford to be sick. I'm going on a trip. My spouse is on Biaxin. My co-workers/ sent me in to get an antibiotic. The daycare won't take her without antibiotics. I feel awful. I have drainage - it's green/bloody/choking me. 	<p>PARTNERSHIP: Joint problem solving</p> <ul style="list-style-type: none"> Let's tackle this together. <p>EMPATHY: Show understanding, put feelings into words</p> <ul style="list-style-type: none"> That sounds hard. You look upset. You seem discouraged. Help me to understand what these symptoms are about. How has this affected you? You look so ill today; it must be so hard to accomplish anything. 																				
<p>Cough and Bronchitis</p> <ul style="list-style-type: none"> Bronchitis in children and adults rarely warrants antibiotic treatment; if non-viral illness is suspected (underlying lung disease?), erythromycin or doxycycline can be used. <p>Seven studies have identified recent antibiotic use as a risk factor for development of infection with resistant pneumococci. To prevent bacterial resistance, avoid unnecessary use of antibiotics. Plan treatment of symptoms for your patients presenting with viral illness.</p>	<p>Communication Strategies for Discussing Viral Illness with Patients</p>	<p>APOLOGY: Show compassion about illness</p> <ul style="list-style-type: none"> I'm sorry you're feeling ill. 																				
<p>OTC Symptom Relief Medications</p> <table border="1"> <thead> <tr> <th>Symptom</th> <th>Medication</th> <th>Active ingredients</th> <th>Examples</th> </tr> </thead> <tbody> <tr> <td>Stuffy nose</td> <td>Decongestant</td> <td>Pseudoephedrine Phenylpropanolamine</td> <td>Sudafed Propages</td> </tr> <tr> <td>Cough</td> <td>Cough suppressant</td> <td>Dextromethorphan</td> <td>Vicks Formula 44</td> </tr> <tr> <td>Chest congestion</td> <td>Expectorant</td> <td>Guaiifenesin</td> <td>Robitussin</td> </tr> <tr> <td>Sore throat</td> <td>Lozenge</td> <td>Benzocaine Glycerin</td> <td>Cylex Vicks Chloraseptic</td> </tr> </tbody> </table>	Symptom	Medication	Active ingredients	Examples	Stuffy nose	Decongestant	Pseudoephedrine Phenylpropanolamine	Sudafed Propages	Cough	Cough suppressant	Dextromethorphan	Vicks Formula 44	Chest congestion	Expectorant	Guaiifenesin	Robitussin	Sore throat	Lozenge	Benzocaine Glycerin	Cylex Vicks Chloraseptic	<ol style="list-style-type: none"> Use PEARLS. Comment on pertinent positive and negative physical findings as exam proceeds. Make reference to popular news articles or other media reports about antibiotics assuming patient is aware of their content. Don't pressure yourself to convince 100% of your patients. Remember your success in prescribing antibiotics appropriately. Keep in mind that many patients will become convinced over time about proper use of antibiotics. For patients who insist on an unnecessary antibiotic, offer the prescription and explain that you care about the patient, but do not support using the antibiotic on medical grounds. For patients whose illness poses diagnostic uncertainty or logistical concerns (travelling, etc), try these suggestions: <ul style="list-style-type: none"> Offer the prescription and provide instructions describing under what circumstances it would be appropriate to fill it and initiate the antibiotic. Suggest the patient call your office in a few days if not better or getting worse. Be sure to provide the patient with an easy mechanism for reaching you (voice mail, beeper, specific nurse or medical assistant contact, etc). Suggest patient return if not improved in a few days. Promise to call the patient in a few days and DO IT. Make an effort to understand the context of the illness in the patient's life and how the patient feels the illness will affect him/her. This may yield clues for suggesting treatment that does not include an antibiotic. Provide education - Explain the natural course of the illness including time markers. Consider showing the patient the CDC symptom v. time graph of upper respiratory infections. Put forth an expression of hope. 	<p>RESPECT: Value patient's choices, traits, behaviors and special qualities</p> <ul style="list-style-type: none"> I appreciate your decision/action. You did the right thing by coming in today. What do you think is going on? What do you think will help? You may need an antibiotic, but first let's see what your exam shows. I'm sure you've seen reports about bacterial resistance caused by improper use of antibiotics. Biaxin (or other drug) is a good antibiotic. It's very popular because it's been heavily advertised. But I think amoxicillin (or other drug) is better for your illness. <p>LEGITIMATION: Normalize and validate feelings and choices</p> <ul style="list-style-type: none"> Anyone would be irritated/miserable with this situation. We're seeing a lot of this illness (cold, flu, virus) lately. It's difficult for most people to tell the difference between a cold, flu, sinus infection or an allergy flare. I can see how you would feel that way. You do have a lot of drainage (or other complaint). <p>SUPPORT: Offer ongoing support</p> <ul style="list-style-type: none"> I'll stick with you as long as necessary. I'm going to help you manage this. Let me offer you some helpful suggestions. Do you need a work note?
Symptom	Medication	Active ingredients	Examples																			
Stuffy nose	Decongestant	Pseudoephedrine Phenylpropanolamine	Sudafed Propages																			
Cough	Cough suppressant	Dextromethorphan	Vicks Formula 44																			
Chest congestion	Expectorant	Guaiifenesin	Robitussin																			
Sore throat	Lozenge	Benzocaine Glycerin	Cylex Vicks Chloraseptic																			

Figure L3. Clinical PEARLS. Reprinted from Information and Resources for Healthcare Providers: MARR, by Michigan Antibiotic Resistance Reduction Coalition, 2004, Retrieved June 27, 2016, from <http://www.mi-marr.org/provider.php>. Reprinted with permission.

Appendix M

Reinforcement Material



Thank you for volunteering in the study of healthcare providers' knowledge, attitude and practice concerning antibiotic use and resistance. The purpose of the study is to raise awareness of the threat of antibiotic resistance and the importance of appropriate antibiotic prescribing and use. You can help prevent antibiotic resistance by not prescribing antibiotics for acute respiratory infections. Remember to educate patients about proper antibiotic use and provide guidance for symptom relief for common infections which do not require an antibiotic.

If you need any information, please contact:
 Cynthia Brown
 Phone: [REDACTED]
 Email: [REDACTED]

Are you up to date on antibiotic prescribing guidelines?
 Click on the picture below to check out the latest recommendations regarding appropriate antibiotic prescribing for respiratory infections in an outpatient setting.



Get Smart: Know When Antibiotics Work!
 Click on the picture below to learn about the CDC program.



This research is conducted under the direction of Dr. Lyla Lindholm and Dr. David LaFevers, University of Missouri – Kansas City School of Nursing, and has been reviewed and approved by the [REDACTED] Hospital Institutional Review Board.

Figure M1. Provider reminder number 1. Reprinted from Get Smart: Know When Antibiotics Work: Graphics – Improving Antibiotic Prescribing, by CDC, 2016, November 2, 2016, from <https://www.cdc.gov/getsmart/community/images/materials/improve-prescribing.jpg>. Reprinted with permission.

Appendix M

Reinforcement Material

Know When Antibiotics Are Indicated
FREE CE: [Click Here](#)

Identify and Validate Patient Concerns
FREE TOOL: [Click Here](#)

Recommend Symptomatic Therapy for Viral Illnesses
FREE TOOL: [Click Here](#)

The power to prevent antimicrobial resistance is in your hands.

NO ANTIBIOTICS FOR VIRAL INFECTIONS

Know When Antibiotics Are Indicated

Identify and Validate Patient Concerns

Recommend Symptomatic Therapy for Viral Illnesses

Get Smart About Antibiotics Week
November 14–20, 2016

For more information visit www.cdc.gov/getsmart or call 1-800-CDC-INFO

Thank you for volunteering in the study of healthcare providers' knowledge, attitude and practice concerning antibiotic use and resistance.
If you need any information, please contact: Cynthia Brown Phone: [REDACTED] or Email: [REDACTED]
This research is conducted under the direction of Dr. Lyla Lindholm and Dr. David LaFavers, University of Missouri – Kansas City School of Nursing, and has been reviewed and approved by the [REDACTED] Hospital Institutional Review Board.

Figure M2. Provider reminder number 2. Reprinted from Get Smart About Antibiotics Week:

Print products, by CDC, 2016, Retrieved November 15, 2016, from

<https://www.cdc.gov/getsmart/week/downloads/ad-hcp-w-links.pdf>. Reprinted with permission.

Appendix M

Reinforcement Material

GET SMART
About Antibiotics Week
www.cdc.gov/getsmart

PRESERVE THE POWER OF ANTIBIOTICS

Antibiotic-resistant bacteria cause more than 2 million illnesses and at least 23,000 deaths each year in the United States. Antibiotic resistance occurs when germs no longer respond to the drugs designed to kill them. Inappropriate prescribing of antibiotics contributes to antibiotic resistance and is a threat to patient safety.

FOR PROVIDERS

Healthcare Providers Can:

- **Prescribe correctly**
 - Avoid treating viral syndromes with antibiotics, even when patients ask for them.
 - Pay attention to dose and duration: The right antibiotic needs to be prescribed at the right dose for the right duration.
 - Be aware of antibiotic-resistance patterns in your area so that you can always choose the right antibiotic.
 - Hospital and nursing home providers should reassess within 48 hours of starting the antibiotic, when the patient's culture results come back. Adjust the prescription, if necessary. Stop the prescription, if indicated.
- **Collaborate with each other and with patients**
 - Talk to your patients about appropriate use of antibiotics.
 - Include microbiology cultures, when possible, when ordering antibiotics.
 - Work with pharmacists to ensure appropriate antibiotic use and prevent resistance and adverse events.
 - Use patient and provider resources offered by the Centers for Disease Control and Prevention (CDC) and professional organizations such as Society for Healthcare Epidemiology.
 - **Provider Resources:** <http://www.cdc.gov/getsmart/>
 - **Patient Resources:** <http://www.cdc.gov/getsmart/community-for-patients/index.html>
 - **General Information:** http://www.cdc.gov/drugresistance/protecting_yourself_family.html
- **Stop the spread**
 - Follow hand hygiene and other infection control measures with every patient.
- **Embrace antibiotic stewardship**
 - Improve antibiotic use in all facilities—regardless of size—through stewardship interventions and programs, which will improve individual patient outcomes, reduce the overall burden of antibiotic resistance, and save healthcare dollars.
 - Recognize and participate in CDC's Get Smart About Antibiotics Week initiatives.

CDC
Centers for Disease Control and Prevention
National Center for Emerging and Zoonotic Infectious Diseases

GET SMART
About Antibiotics Week
www.cdc.gov/getsmart

PRESERVE THE POWER OF ANTIBIOTICS

Inpatient Settings

- Overuse of antibiotics creates an unnecessary risk for adverse drug events, such as *Clostridium difficile* infection, a sometimes deadly diarrhea.
- Antibiotic resistance adversely impacts the health of millions of hospitalized patients every year.
- Some infections in hospitals are now resistant to all available antibiotics.
- About 40% of the patients receiving antibiotics receive unnecessary or inappropriate therapy.

Outpatient Settings

- Each year, millions of antibiotics are prescribed unnecessarily for viral infections.
- Antibiotics can cause adverse drug events and promote antibiotic resistance.
 - There are more *Clostridium difficile* infections in places with more antibiotic use.
 - Antibiotic use in primary care is associated with antibiotic resistance at the individual patient level.
- Antibiotics cause 1 in 5 emergency department visits for adverse drug events and are the most common cause of emergency department visits for adverse drug events in children.

For more information, visit CDC's Get Smart program website:
Get Smart Resources for Healthcare Providers
<http://www.cdc.gov/getsmart/week/educational-resources/hcp.html>

Centers for Disease Control and Prevention
For more information, please contact Centers for Disease Control and Prevention.
1600 Clifton Road N.E., Atlanta, GA 30333
Telephone: 1-800-CDC-INFO (232-4656)/TTY: 1-888-232-6354
Email: getsmart@cdc.gov Web: www.cdc.gov/getsmart

Figure M3. Provider reminder number 3. Reprinted from Get Smart: Know When Antibiotics Work: Print material for Healthcare Professionals, by CDC, 2016, Retrieved December 7, 2016, from <https://www.cdc.gov/getsmart/week/downloads/gsw-factsheet-providers.pdf>. Reprinted with permission.

Appendix M

Reinforcement Material

Antibiotic resistance is a public health crisis

- Approximately 50% of antibiotics prescribed are not necessary, nevertheless antibiotics are one of the most often prescribed outpatient medications in the United States.
- In the United States, there are over 2 million illnesses and at least 23,000 deaths yearly as a direct result of antibiotic-resistant infections, leading to more than 8 million additional hospital days and costing the healthcare system an excess of \$20 billion a year and \$35 billion a year in lost wages.

Antibiotics are not for treatment of viruses

CONDITION	EPIDEMIOLOGY	DIAGNOSIS	MANAGEMENT
URI	At least 200 viruses can cause the common cold.	Symptoms include fever, cough, rhinorrhea, postnasal drip nasal congestion, sore throat, headache, and myalgias.	Focus on symptomatic relief: rest, antipyretics, analgesics, decongestants, antihistamines, humidifier. <u>Antibiotics should NOT be prescribed for these conditions.</u>
Pharyngitis	Caused by virus in 80-90% of cases.	Clinical features alone do not distinguish between group A strep and viral pharyngitis; a rapid antigen detection test is necessary.	<u>Antibiotic treatment is NOT recommended</u> for patients with negative rapid strep results.
Bronchitis	Caused by virus in 90% of cases.	Chest x-ray if temp >38 C, respirations >24, pulse >100, adventitious lung sounds. Colored sputum does not indicate bacterial infection.	<u>Antibiotics are NOT recommended</u> , regardless of cough duration. Symptomatic therapy: cough suppressants, antihistamines, decongestants, and beta agonists inhalers.

Patient communication

- Provide specific diagnosis
- Offer symptomatic relief therapy
- Voice what is seen during exam
- Inform about antibiotic use and increased resistance
- Advise on what to expect with illness
- Reassure the patient
- Learn how to say "No" when patient asks for antibiotics that are not necessary
 - a) Put no in an explanation
 - Be diplomatic and less confrontational
 - b) Open a discussion and explain
 - Try to find out why they want antibiotic
 - c) Be willing to negotiate
 - Offer explanation of why what they want is incorrect and provide alternative
 - d) Be a cheerleader
 - Tell them they are doing the correct thing and sometimes resolution of symptoms takes time
 - e) Show patient's empathy and compassion
 - Acknowledge they are sick and let them know you understand their frustration
 - f) Be firm when needed

Thank you for volunteering in the study of healthcare providers' knowledge, attitude and practice concerning antibiotic use and resistance.

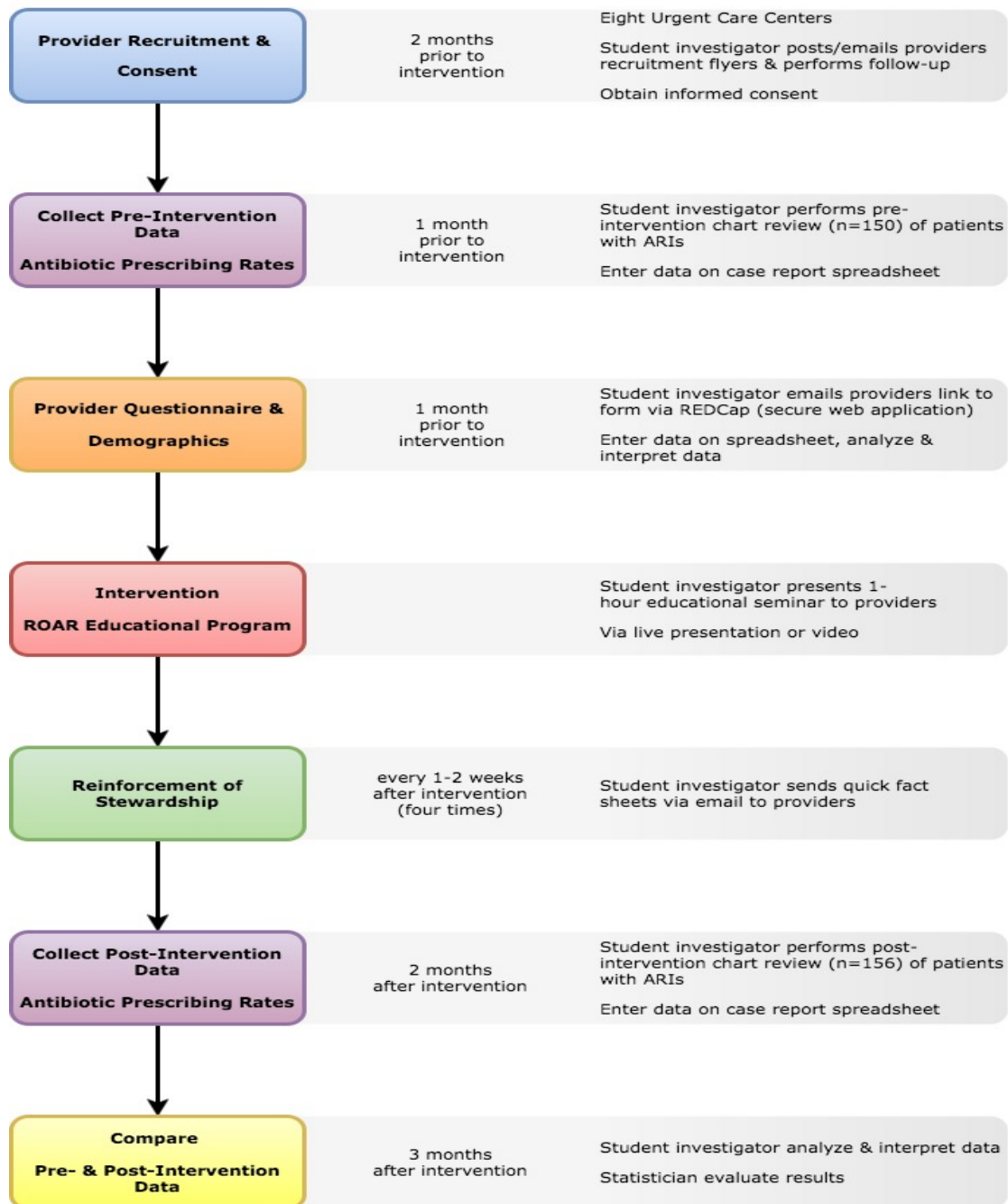
If you need any information, please contact: Cynthia Brown Phone: [REDACTED] or Email: [REDACTED]

This research is conducted under the direction of Dr. Lyla Lindholm and Dr. David LaFevers, University of Missouri – Kansas City School of Nursing, and has been reviewed and approved by the [REDACTED] Hospital Institutional Review Board.

Figure M4. Provider reminder Number 4.

Appendix N

Intervention Flow Design



Appendix O

Application of Change Theory

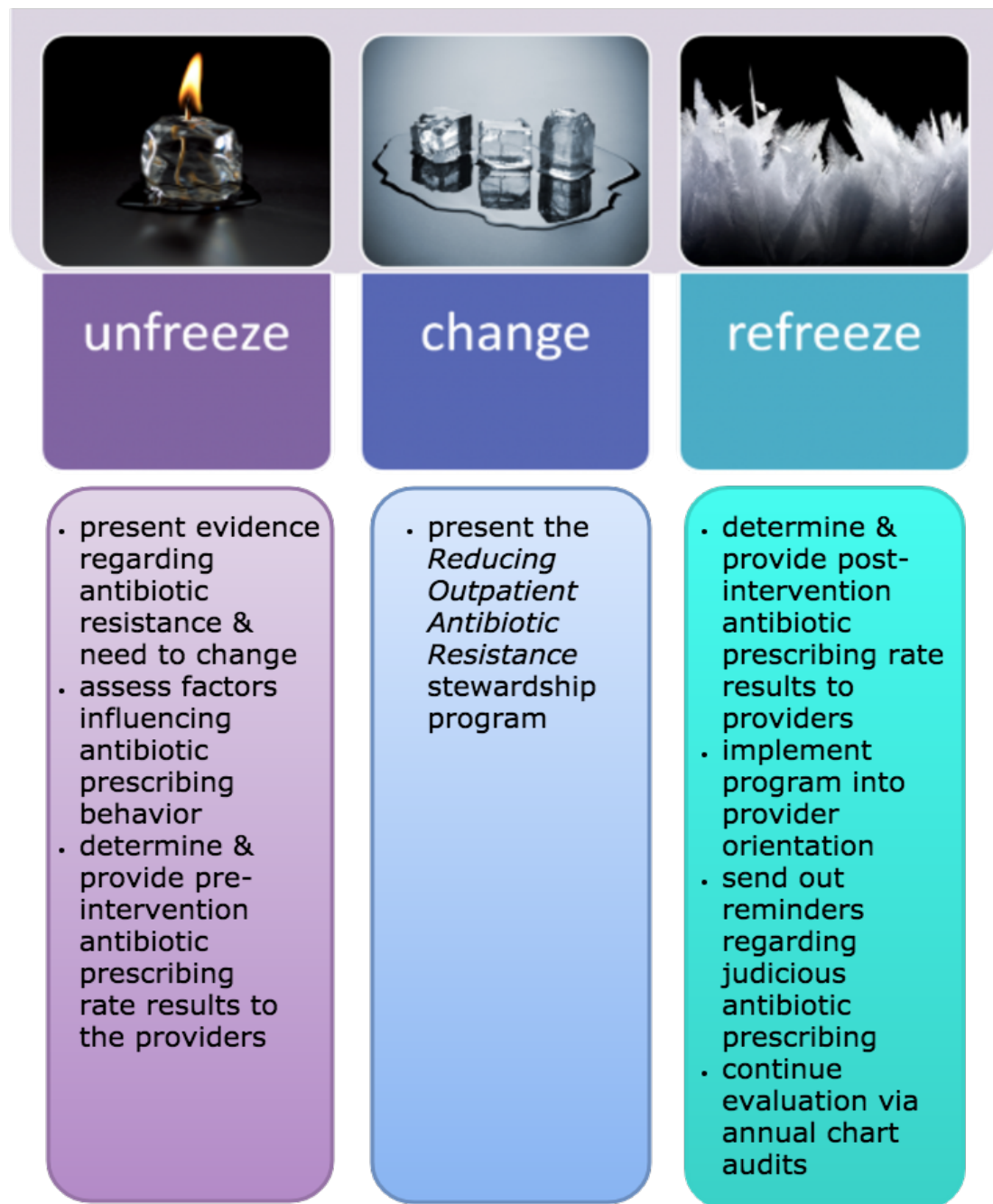


Figure O1. DNP project change theory. This figure illustrates effective elements in Kurt Lewin's change theory applied to the DNP intervention. Adapted from an image by Lundberg (2010).

Appendix P

Project Timeline

Task	2016												2017				
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
SELECT A TOPIC																	
Identify practice problem & develop PICOT question	█	█															
FORM A TEAM																	
Discuss DNP project with managers of urgent care centers	█	█	█														
RETRIEVE RELEVANT RESEARCH EVIDENCE																	
Conduct comprehensive literature review	█	█	█														
CRITIQUE AND SYNTHESIZE RESEARCH																	
Critically appraise literature and summarize evidence	█	█	█														
Choose EBP model & theoretical conceptual framework			█	█													
PROJECT DESIGN																	
Formulate detailed plan for implementation of evidence				█	█												
Design study & develop methods				█	█												
Write research proposal						█	█										
Present proposal to UMKC faculty						█	█										
Acquire IRB approval for project implementation & dissemination							█										
PROJECT EXECUTION																	
Implement DNP project: recruitment of participants								█	█								
Collect & collate pre-intervention data (chart audit)								█	█	█							
Distribute, analyze & interpret provider questionnaire & demographics								█	█	█							
ROAR educational program - live and video presentation									█	█							
Collect & collate post-intervention data (chart audit)											█	█	█				
PROJECT EVALUATION & REPORTING																	
Disseminate project proposal: poster at APNO Conference											█						
Analyze data (chart audit: pre- & post-intervention) & interpret findings													█	█			
Disseminate findings: executive summary to IRB, study providers & management; poster at UMKC Student Research Summit; manuscript to <i>Journal of Doctoral Nursing Practice</i>															█	█	

Appendix Q

Logic Model for DNP Project

PICOTS: In healthcare providers at urban urgent care centers, does an antibiotic stewardship program *Reducing Outpatient Antibiotic Resistance* compared to the current practice of no program reduce the prescribers' inappropriate use of antibiotics to treat ARIs and change healthcare providers' knowledge and attitudes regarding antibiotic use resistance within four months following the antibiotic stewardship program?

Inputs	Intervention(s) Activities	Outputs Participation	Outcomes -- Impact		
			Short	Medium	Long
<p>Evidence, sub-topics</p> <p>Understanding healthcare provider antibiotic prescribing behavior.</p> <p>Knowledge, attitudes and practices (KAP) among healthcare providers regarding antibiotic use & resistance.</p> <p>Evidence-based guidelines for treatment of acute respiratory infections.</p> <p>Interventions to reduce healthcare provider antibiotic prescribing for acute respiratory infections.</p> <ul style="list-style-type: none"> • Provider education. • Provider feedback. • Provider decision support system. • Guidelines. • Communication skills training. <p>Major Facilitators or Contributors</p> <p>Urgent care center MD & NP managers.</p> <p>Major Barriers or Challenges</p> <p>Healthcare providers in the urgent care centers Hospital administrators.</p>	<p>EBP intervention which is supported by the evidence in the Input column</p> <p>Reducing outpatient antibiotic resistance stewardship program.</p> <p>Major steps of the intervention</p> <p>Chart review to obtain antibiotic prescribing rate for acute respiratory infections.</p> <p>Administration of survey to assess factors influencing healthcare provider prescribing behavior.</p> <p>Presentation of stewardship program.</p> <p>Chart review to obtain antibiotic prescribing rate for acute respiratory infections 2-3 months after stewardship program.</p> <p>Comparison of post-intervention chart audit to baseline chart audit.</p>	<p>The participants (subjects)</p> <p>Healthcare providers: doctors and nurse practitioners.</p> <p>Site</p> <p>Eight urgent care centers in large metropolitan area in MO.</p> <p>Time Frame</p> <p>Estimated 3-4 months.</p> <p>Consent Needed or other</p> <p>Informed consent from each participant.</p> <p>Person(s) collecting data</p> <p>Student investigator.</p> <p>Others directly involved</p> <p>None.</p>	<p>(Completed as student) Outcome(s) to be measured with valid & reliable tool(s)</p> <p>Antibiotic prescribing rates for acute respiratory infections. Case report spreadsheet designed.</p> <p>Differences in acute respiratory infection antibiotic prescribing rates between MD & NP providers. Case report spreadsheet.</p> <p>Attitude & knowledge regarding antibiotic prescribing & resistance. KAP survey developed by Rodrigues et al. (2016).</p> <p>Statistical analysis to be used</p> <p>Power analysis to estimate number of patient charts required to detect significant change.</p> <p>Antibiotic prescribing rates determined by proportion of visits for acute respiratory infections with a prescription for antibiotic.</p> <p>Wilcoxon Sign rank, McNemar's and Chi-square tests to detect differences between pre- & post-intervention antibiotic prescribing rates.</p> <p>Frequency distribution table reporting provider demographics.</p> <p>Mann-Whitney U test to assess attitudes, factors that influence antibiotic prescribing and most/least important source of knowledge.</p>	<p>(after student DNP) Outcomes to be measured</p> <p>Antibiotic prescribing rates via random chart audits on a quarterly or biannual basis.</p> <p>Broad-spectrum antibiotic use for acute respiratory infections.</p>	<p>(after student DNP) Outcomes that are potentials</p> <p>Patient return visit (\leq 30 days from incident visit) rates.</p> <p>Adverse events within 30 days of index visit.</p>

Appendix R2

Acceptable ICD-10 Codes

ICD-10 Code	Diagnosis
J00	Acute nasopharyngitis (common cold)
J02	Acute pharyngitis
J02.8	Acute pharyngitis due to other specified organisms
J02.9	Acute pharyngitis unspecified
J03	Acute tonsillitis
J03.8	Acute tonsillitis due to other specified organisms
J03.9	Acute tonsillitis unspecified
J04	Acute laryngitis tracheitis
J04.0	Acute laryngitis
J06	Acute URI multiple unspecified sites
J06.0	Acute laryngopharyngitis
J06.9	Acute URI unspecified
J09.X	Flu due to id novel influenza A
J10	Flu due to id seasonal flu
J10.1	Flu other respiratory manifest seasonal flu id
J11	Flu virus not id
J11.1	Flu other respiratory manifest id
J20	Acute bronchitis
J20.8	Acute bronchitis due to other specified organisms
J20.9	Acute bronchitis unspecified
J21	Acute bronchiolitis
J21.8	Acute bronchiolitis due to other specified organisms
J21.9	Acute bronchiolitis unspecified
J22	Unspecified lower respiratory infection
J30	Vasomotor allergic rhinitis
J30.0	Vasomotor rhinitis
J30.1	Allergic rhinitis due to pollen
J30.2	Other seasonal allergic rhinitis
J30.3	Other allergic rhinitis
J30.4	Allergic rhinitis unspecified
J39	Other diseases upper respiratory tract
J39.98	Other specified diseases of upper respiratory tract
J39.9	Disease upper respiratory tract unspecified

Note. ICD-10 = International Classification of Diseases, 10th Revision, URI = upper respiratory infection.

Appendix R3

Excluded ICD-10 Codes

ICD-10 Code	Diagnosis
J01.0 to J01.9	Acute sinusitis
J02.0	Streptococcal pharyngitis
J03.0	Streptococcal tonsillitis
J05.0	Acute obstructive laryngitis (croup)
J05.1	Acute epiglottitis
J12 to J18	Pneumonia
J31 to J37	Chronic diseases of upper respiratory tract
J38.0 to J38.7	Diseases of vocal cords and larynx, not elsewhere classified
J39.0 to J39.9	Other diseases of upper respiratory tract
J40 to J47	Chronic lower respiratory diseases
H65 to H75	Diseases of middle ear and mastoid

Note. ICD-10 = International Classification of Diseases, 10th Revision.

Appendix S


Provider and Patient Spreadsheet Template

Provider	Code

Patient ID	Patient Initials	Code

Appendix T


Healthcare Provider Questionnaire




QUESTIONNAIRE N°: _____

FILLING INSTRUCTIONS											
<p>In the left column are questions that will be the subject of your evaluation and in the right column there is a gradual scale where you should mark with a cross the place where, accordingly to your opinion represents your agreement with the text comment. If you are totally in disagreement, you should place a cross at the left end, and as your agreement increases you should move the cross to the right.</p>	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; padding: 2px;">totally disagree</th> <th style="text-align: right; padding: 2px;">totally agree</th> </tr> </thead> <tbody> <tr> <td style="border: 1px solid black; padding: 2px;"> X----- </td> <td style="border: 1px solid black; padding: 2px;"> ----- </td> </tr> <tr> <td style="border: 1px solid black; padding: 2px;">0</td> <td style="border: 1px solid black; padding: 2px;">100%</td> </tr> <tr> <td style="border: 1px solid black; padding: 2px;"> -----X----- </td> <td style="border: 1px solid black; padding: 2px;"> -----X----- </td> </tr> <tr> <td style="border: 1px solid black; padding: 2px;"> ----- </td> <td style="border: 1px solid black; padding: 2px;"> -----X </td> </tr> </tbody> </table>	totally disagree	totally agree	X-----	-----	0	100%	-----X-----	-----X-----	-----	-----X
totally disagree	totally agree										
X-----	-----										
0	100%										
-----X-----	-----X-----										
-----	-----X										

ABOUT ANTIBIOTICS AND RESISTANCES		
	Totally disagree	totally agree
1. Antibiotic resistance is an important Public Health problem in our setting.	-----	-----
2. In a primary-care context, one should wait for the microbiology results before treating an infectious disease.	-----	-----
3. Rapid and effective diagnostic techniques are required for diagnosis of infectious diseases.	-----	-----
4. The prescription of an antibiotic to a patient does not influence the possible appearance of resistance.	-----	-----
5. I am convinced that new antibiotics will be developed to solve the problem of resistance.	-----	-----
6. The use of antibiotics on animals is an important cause of the appearance of new resistance to pathogenic agents in humans.	-----	-----
7. In case of doubt, it is preferable to use a wide-spectrum antibiotic to ensure that the patient is cured of an infection.	-----	-----
8. I frequently prescribe an antibiotic in situations in which it is impossible for me to conduct a systematic follow-up of the patient.	-----	-----
9. In situations of doubt as to whether a disease might be of bacterial aetiology, it is preferable to prescribe an antibiotic.	-----	-----
10. I frequently prescribe antibiotics because patients insist on it.	-----	-----
11. I sometimes prescribe antibiotics so that patients continue to trust me.	-----	-----
12. I sometimes prescribe antibiotics, even when I know that they are not indicated because I do not have the time to explain to the patient the reason why they are not called for.	-----	-----
13. If a patient feels that he/she needs antibiotics, he/she will manage to obtain them at the pharmacy without a prescription, even when they have not been prescribed.	-----	-----
14. Two of the main causes of the appearance of antibiotic resistance are patient self-medication and antibiotic misuse.	-----	-----
15. Dispensing antibiotics without a prescription should be more closely controlled.	-----	-----
16. In a primary-care context, amoxicillin is useful for treating most respiratory infections.	-----	-----
17. The phenomenon of resistance to antibiotics is mainly a problem in hospital settings.	-----	-----



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Figure T1. Provider questionnaire, page 1 of 2. Developed by Rodrigues et al, 2016, <http://link.springer.com/article/10.1186/s12879-015-1332-y>. Reprinted with permission <http://creativecommons.org/licenses/by/4.0/>.

Appendix T

Healthcare Provider Questionnaire


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IN THE TREATMENT OF RESPIRATORY TRACT INFECTIONS, HOW WOULD YOU RATE THE USEFULNESS OF EACH OF THESE SOURCES OF KNOWLEDGE?:

	totally disagree	totally agree
Clinical practice guidelines.	-----	-----
Documentation furnished by the Pharmaceutical Industry.	-----	-----
Courses held by the Pharmaceutical Industry.	-----	-----
Information furnished by Medical Information Officers.	-----	-----
Previous clinical experience.	-----	-----
Continuing Education Courses.	-----	-----
Others, e.g., contribution of specialists (microbiologists, infectious disease specialists, etc.).	-----	-----
Contribution of peers (of the same specialisation).	-----	-----
Data collected via the Internet.	-----	-----

Some questions about sociodemographic data and about your clinical practice

How old are you? ____ years

Gender: F M

What is your medical specialization?

Do you work at the emergency service?
Yes
No

What type of activity?

Public practice

Private practice

Both

In which workplace?

Hospital care

Primary care

Both


Approximately, what is the number of patients seen per day? ____ patients

Approximately, what is the number of patients seen per day at the emergency service? ____ patients

Approximately, how much time do you need to attend one patient?
____ minutes

DO YOU HAVE SOME SUGESTIONS ABOUT ANTIBIOTIC USE AND RESISTANCES?

THANK YOU VERY MUCH FOR YOUR COOPERATION!


Centro de Biologia Celular



CS universidade de aveiro
secção autónoma de ciências da saúde

Figure T2. Provider questionnaire, page 2 of 2. Developed by Rodrigues et al, 2016, <http://link.springer.com/article/10.1186/s12879-015-1332-y>. Reprinted with permission <http://creativecommons.org/licenses/by/4.0/>

Appendix V

Characteristics of Study Providers

Characteristic	Nurse Practitioner	Physician
Provider type, <i>n</i> (%)	5 (62.5)	3 (37.5)
Sex, <i>n</i> (%)		
Male		1 (33)
Female	5 (100)	2 (67)
Years practicing, mean	4	23.33
Years in UCC, mean	2.4	7.33
Number of patients seen per day, mean	20.6	22.33
Time (minutes) needed to see patient, mean	18.4	20

Note. UCC = urgent care center.

Appendix W

Comparison of Patient Encounters Before and After the ROAR Intervention

Characteristic	Pre-Intervention (N = 150)		Post-Intervention (N = 156)	
Age, mean, range	37.19, 3 months-89 years		38.15, 1-86 years	
Duration of illness, mean, range	5.48, 0.25-30 days		5.23, 0.25-60 days	
Sex, <i>n</i> (%)				
Male	43 (28.7)		63 (40.4)	
Female	107 (71.3)		93 (59.6)	
Number of encounters, <i>n</i> (%)				
NP	90 (60)		100 (64.1)	
MD	60 (40)		56 (35.9)	
Patient primary PMH, <i>n</i> (%)				
1 st	None 72 (48)		None 80 (51.3)	
2 nd	HTN 15 (10)		HTN 24 (15.4)	
3 rd	Asthma 14 (9.3)		Asthma 10 (6.4)	
Diagnosis, <i>n</i> (%)				
1 st	Pharyngitis 52 (34.67)		URI 71 (45.52)	
2 nd	URI 47 (31.33)		Pharyngitis 41 (26.28)	
3 rd	Bronchitis 42 (28)		Bronchitis 38 (24.36)	
4 th	Tonsillitis 5 (3.33)		Tonsillitis 2 (1.28)	
5 th	Laryngitis 3 (2)		Laryngitis 2 (1.28)	
6 th	Common Cold 1 (0.67)		Unspecified LRI 2 (1.28)	
Antibiotic prescribing rate, <i>n</i> (%)	<u>No</u>	<u>Yes</u>	<u>No</u>	<u>Yes</u>
Total	105 (70)	45 (30)	126 (80.77)	30 (19.23)
Male	25 (16.67)	18 (12)	50 (32.05)	13 (8.33)
Female	80 (53.33)	27 (18)	76 (48.72)	17 (10.9)
NP	72 (48)	18 (12)	89 (57.05)	11 (7.05)
MD	33 (22)	27 (18)	37 (23.72)	19 (33.93)
Diagnosis given antibiotic, <i>n</i> (%)				
1 st	Bronchitis 20 (13.4)		Bronchitis 20 (12.8)	
2 nd	Pharyngitis 14 (9.3)		URI 4 (2.6)	
3 rd	URI 9 (6)		Pharyngitis 4 (2.6)	
Most prescribed antibiotic, <i>n</i> (%)				
1 st	Zithromax 20 (13.3)		Zithromax 22 (14.1)	
2 nd	Amoxicillin 13 (8.67)		Amoxicillin 4 (2.56)	
3 rd	Augmentin 3 (2)		Doxycycline 3 (1.92)	
4 th	Keflex 3 (2)		Augmentin 1 (0.64)	

Note. HTN = hypertension, LRI = lower respiratory infection, MD = physician, NP = nurse practitioner, URI = upper respiratory infection.

Appendix X

Pre- and Post-Intervention Antibiotic Prescribing Rates

Provider	Pre-Antibiotic Prescribing Rate %	Post-Antibiotic Prescribing Rate %	Percentage Difference %	Relative Reduction %	Absolute Reduction %
NP	15	0	200	-100	-15
NP	20	25	22.22	25	5
MD	60	65	8	8.33	5
NP	45	15	100	-66.67	-30
MD	35	0	200	-100	35
NP	5	15	100	200	10
NP	15	0	200	-100	-15
MD	40	37.50	6.45	-6.25	-2.50

Note: MD = physician, NP = nurse practitioner, percentage difference = $\{(pre - post)/[(pre + post)/2]\} \times 100$, relative reduction = $[(post - pre)/pre] \times 100$, absolute reduction = post - pre.

Appendix Y

Antibiotic Prescribing Statistical Analysis Results

Outcome	Pre-Intervention	Post-Intervention	<i>p</i> value	Absolute Reduction
Antibiotic prescribing rates				
All charts	30 %	20 %	.078	10 %
NP	20 %	12 %	.210	8 %
MD	45 %	34 %	.327	11 %
Preference in antibiotic prescribing				
Odds ratio of NPs preferring not to prescribe antibiotic	3.273		.001	
Odds ratio of NPs preferring not to prescribe antibiotic		4.155	< .0005	

Note. MD = physician, NP = nurse practitioner.

Appendix Z

KAP Questionnaire Attitudes, Influencing Factors and Knowledge Results

	Nurse Practitioner	Physician	All Providers	p value
ATTITUDES				
ABX resistance is problem in our setting, mean %, median %	M = 89.60 Mdn = 98.00	M = 96.67 Mdn = 100.00	M = 92.25 Mdn = 99.00	.571
ABX resistance is problem nationally, mean %, median %	M = 98.00 Mdn = 98.00	M = 93.67 Mdn = 100.00	M = 96.38 Mdn = 98.50	.786
ABX overused in our setting, mean %, median %	M = 83.40 Mdn = 89.00	M = 86.67 Mdn = 85.00	M = 84.43 Mdn = 87.00	1.0
ABX overused nationally, mean %, median %	M = 90.40 Mdn = 99.00	M = 88.33 Mdn = 85.00	M = 89.63 Mdn = 96.00	.786
Factors Influencing ABX Prescribing				
Greatest fear, Mdn %	In case of doubt, preferable to use wide-spectrum ABX to ensure cure 73	Frequently prescribe ABX when impossible to conduct patient f/u 65	Frequently prescribe ABX when impossible to conduct patient f/u 51	.250
Greatest complacency, Mdn %	Sometimes prescribe ABX so patients continue to trust me 31	Frequently prescribe ABX because patients insist 25	Sometimes prescribe ABX so patients continue to trust me 25	.571
Greatest ignorance, Mdn %	Amoxicillin is useful for treating most respiratory infections 62	Amoxicillin is useful for treating most respiratory infections 35	Wait for micro results before treating infectious disease 49.5	.393
Greatest indifference, Mdn %	ABX prescribed due to no time to explain to patient why unnecessary 34	ABX prescribed due to no time to explain to patient why unnecessary 11	ABX prescribed due to no time to explain to patient why unnecessary 21.5	.036
Greatest responsibility of others, Mdn %	Dispensing ABX without prescription needs to be more closely controlled 95	Dispensing ABX without prescription needs to be more closely controlled 97	Dispensing ABX without prescription needs to be more closely controlled 96	1.0
Sources of Knowledge				
Most important, Mdn %	CEU 85	Specialists & CEU 90	CEU 85	1.0
Least important, Mdn %	Medical info officer 45	Internet 50	Internet 50	.571

Note. ABX = antibiotic, CEU = continuing education unit, f/u = follow up, KAP = knowledge, attitude and practice, M = mean, Mdn = median.

Appendix Z2

University of Missouri Kansas City School of Nursing and Health Studies Proposal Approval

Letter



July 18, 2016

Members of the Institutional Review Board

IRB,

This letter serves to provide documentation regarding Cynthia Brown's Doctor of Nursing Practice (DNP) Project proposal. Ms. Brown obtained approval for her project proposal, *Reducing Outpatient Antibiotic Resistance: A Quasi-Experimental Study*, from the School of Nursing DNP faculty committee on July 18, 2016.

If I can provide any further information, please feel free to contact me.

Sincerely,

A handwritten signature in black ink that reads "Susan J. Kimble". The signature is written in a cursive style and is contained within a thin black rectangular border.

Susan J. Kimble, DNP, RN, ANP-BC, FAANP
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DNP Programs Director
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