Rural Facilities as Antibiotic Stewards: A Practice Improvement Pilot in Implementing Symptom-Based Treatment Guidelines

Michele E. Reisinger, DNP, APRN, FNP-BC [1*]

Amanda L. Hartman, DNP, APRN, FNP-C [2]

[1]Assistant Professor, School of Nursing, Washburn University, michele.reisinger@washburn.edu

[2] Assistant Professor, School of Nursing, Washburn University, amanda.hartman@washburn.edu

*Correspondence: Michele E. Reisinger

Abstract

Purpose: Associated with evolving requirements set forth by the Centers for Medicare and Medicaid Services (CMS), critical access facilities must implement prospective processes to address antibiotic stewardship. The purpose of this pilot project was to implement and evaluate a multifaceted, team-based approach to reduce the inappropriate prescribing of antibiotics for female patients diagnosed with uncomplicated UTIs, in a midwestern rural primary care clinic. **Sample:** A cumulative 104 patient cases were abstracted associated with the data collection implementation phase. Consisting of female patients between the ages of 18 and 55 years. Eleven rural primary care providers practicing in a Midwestern Kansas rural community participated in pilot surveys.

Methods: A Quality Improvement (QI) design was employed. A retrospective chart audit was completed to establish baseline knowledge of pre-implementation processes and treatment patterns coupled with a post-implementation chart audit for comparative analysis. A pre-test/post-test survey tool was administered to evaluate the knowledge and attitudes of providers. Standardized patient triage, clinical treatment pathways, delayed antibiotic prescriptions, symptom-based

palliative “prescriptions”, over-the-counter take-home kits, and patient-centered provider-driven education were the foundation of this pilot.

Findings: Post-intervention data supports the implementation of team-based strategies and standardized treatment pathways as an effective mechanism in promoting adherence to evidence-based guidelines to reduce inappropriate antibiotic prescribing.

Conclusions: Despite limited resources which are often identified in the literature as barriers in rural settings, this pilot demonstrated that a team-based approach appraising clinic processes aids in determining potential gaps in the provision of safe and evidence-based care. Educating ancillary staff and rural providers alike serves to improve antibiotic stewardship outcomes. Patients must be an integral component of the change process which may be facilitated using tangible resources to treat symptoms when antibiotics are not indicated at the initial point of patient/provider contact.

Keywords: antibiotic stewardship, UTI, rural health

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Antibiotic resistance is prevalent throughout the United States (U.S.), with identified health disparities existing for individuals living in rural geographic locations. The Midwest maintains the second highest utilization of antibiotics following the South (Centers for Disease Control and Prevention, [CDC], 2017). Health improvements for Americans living in rural settings have not kept pace with those living in urban locations, and rural counties with high levels of poverty (≥ 15%) account for most mortality disparities between rural and urban counties (Cosby et al., 2019). Rural primary care settings tend to have considerably more limitations in staffing, infrastructure,

and resources which make implementing antibiotic stewardship programs more difficult (CDC, 2020; Health Resources and Services Administration, (n.d.).

The Centers for Disease Control and Prevention reported that more than 2.8 million antibiotic-resistant infections occurred in 2019, and up to 35 deaths occurred as a direct result of antibiotic resistance (CDC, 2022). Along with increased mortality, antibiotic resistance also leads to a decreased ability to effectively treat infectious diseases. Urinary tract infections (UTI) are frequently treated with antibiotics, often inappropriately without consideration of clinical practice guidelines or local antibiograms (Anger, et al., 2019).

Rural providers are associated with a higher likelihood of being a "high prescriber" while also being more likely to utilize greater quantities of broad-spectrum antibiotics when compared to non-high prescribers (Staub et al., 2020). While national benchmarks have been established aimed at improving outpatient antibiotic prescribing and usage, a gap exists in available resources targeted toward assisting rural providers with implementing meaningful antibiotic prescription-reducing strategies into practice. One proposed solution was enacted in January 2023 requiring that all hospitals have active antibiotic stewardship programs (ASP) in compliance with Centers for Medicare & Medicaid Services (CMS) regulatory measures (CMS, 2022). Numerous studies have found that smaller hospitals (<200 beds) are less likely to have an active ASP and/or pharmacy support for facilitating antibiotic stewardship practices (Stenehjem et al., 2017). Many ASPs focus on primary care providers (PCP), and while this is a reasonable starting point, it is imperative to recognize that PCP are not solely responsible for antibiotic stewardship. Often PCP do not have expertise regarding infectious diseases which facilitates the need for an interdisciplinary approach consisting of pharmacists, laboratory staff, nurses, and other care team members that can serve as invaluable resources to a prescriber (Tate, 2010). Nursing professionals

are primed to serve as antibiotic stewards, as a study by Ervin et al. (2021) noted that nurses were perceived as "gatekeepers" to antimicrobial initiatives within a rural primary care setting.

A key theme throughout the literature emphasized that a multifaceted approach is necessary to achieve successful long-term outcomes related to antibiotic stewardship. Oftentimes, programs fail because they only focus on one aspect of the problem, such as provider education or developing a prescribing protocol. While those areas of focus should be included, when individually implemented they do not address the complexity of the problem. A qualitative study by Duane at al. (2016) involving both providers and patients revealed that prescribing antibiotics for a UTI is a more complex interpersonal interaction than often assumed. Patients and providers alike have self-driven agendas, pressures, and values that they are trying to negotiate during a consultation.

As part of a broader mixed-methods quality improvement pilot program, a two-pronged approach was implemented in a rural primary care setting. For the purposes of this pilot project, "rural" was defined per the Kansas Department of Health and Environment (KDHE) guidelines of any geographic area that is not considered "urbanized" per U.S. Census data, with a current healthcare shortage designation (Kansas Department of Health and Environment [KDHE], n.d.). Additionally, the pilot clinic was classified as a Kansas Medicare-Certified Rural Health Clinic. The aim of this pilot project centered around rural health clinic process standardization by intentional critical appraisal of patient triage, evaluation, and treatment of individuals presenting with uncomplicated UTI symptoms. A collaborative team-based approach was foundational in this project to coincide with established evidence-based literature.

Methods

The purpose of this UTI pilot project was to implement and evaluate a multifaceted approach to reduce the inappropriate prescribing of antibiotics for female patients aged 18 to 55 years, diagnosed with uncomplicated UTI, in a rural primary care clinic.

Sample

A cumulative 104 patient cases were abstracted associated with the data collection implementation phase. The sample consisted of female patients between the ages of 18 and 55 years. Eleven rural PCP practicing in a Midwestern Kansas rural community participated in pilot surveys (See Table 1).

A quality improvement (QI) design was chosen for this project using the Plan Do Study Act (PDSA) cycle which was implemented by a doctoral-level nursing project group in a rural primary care setting within a Critical Access Hospital in Kansas. The community served by this clinic (population of approximately 3,500 individuals) has roughly 20% of individuals that utilize Medicaid, 40% Medicare, and 40% that utilize commercial insurance and has a poverty rate of 17%.

Intervention

The intervention sought to standardize the process and treatment for uncomplicated UTI diagnoses by addressing areas such as establishing standard pathways for patient triage at the initial point of contact with front-office and nursing staff, delaying antibiotic prescriptions pending culture results, introducing tools to educate patients regarding urinary symptomatic treatment such as take-home relief "kits" with printed educational material (see Appendix Figure 1), and consistency in documentation for UTI treatment.

A multifaceted intervention process was initiated within the clinic consisting of customized telephone triage scripts for reception and nursing staff to delineate patients in need of a provider appointment to decrease "phone medicine" type encounters. Providers and nursing staff were given asynchronous PowerPoint presentations detailing the use of the KDHE symptom management Rx card (see Appendix Figure 2). Providers were also encouraged to implement a step-by-step treatment protocol for all patients presenting with urinary symptoms (see Appendix Figure 3). An intervention protocol was implemented to guide provider decision-making to reduce the number of cases in which unnecessary antibiotics were prescribed prior to UA collection.

Data Collection

Institutional Review Board (IRB) approval was obtained from the sponsoring academic institution and not required by the participating rural facility. A retrospective chart audit was completed to establish baseline knowledge of pre-implementation processes and treatment patterns, as well as, a post-implementation chart audit for comparative analysis. Additionally, a pre-test/post-test survey tool was administered to evaluate the knowledge and attitudes of providers within the rural primary care pilot site. Quantitative data from PCP were collected via paper survey. This survey distributed to the participating PCP consisted of two validated and reliable surveys utilizing Likert Scale measures: a survey developed by Watkins et al. (2015) was combined with a survey developed by Adorka, et al. (2013) that assessed provider attitudes, knowledge, and opinions regarding antibiotic prescribing. Authorization to utilize both surveys was obtained by the project team from authors via electronic mail. Following completion of the project's implementation, PCP completed the survey once again for the project team to evaluate provider perceptions. Informal conversations with office and nursing staff helped to gain understanding of current processes in-place and allowed the team to develop suggestions for each

role to support project initiative implementation. Practice provider demographics and pre/post survey responses are summarized in Table 1 below.

Table 1

Provider Characteristics (N=11)

	% (*n*)
Age (years)	
18-29	9% (1)
30-39	18% (2)
40-49	36% (4)
50+	36% (4)
Female	55% (6)
Professional Title	
MD	55% (6)
APRN	27% (3)
PA	18% (2)
Experience (years)	
0-5	18% (2)
6-10	18% (2)
11-15	27% (3)
15+	36% (4)

The facility Information Technology (IT) Department was contacted, and an IT Champion was selected to extract pre-/post-implementation patient chart data. The pre-implementation reporting dates encompassed April 1, 2020, to October 1, 2020. Post-implementation date range spanned November 12, 2020, through February 19, 2021. Report demographics included female patients between the ages of 18 and 55 years of age and was limited to the following diagnoses: N39.0 (other disorders of urinary system), R30.0 (pain associated with micturition), R31.9 (hematuria unspecified), R35.0 (polyuria), N30.9 (cystitis unspecified), R82.81 (pyuria), R10.0 (acute abdomen), N30.0 (acute cystitis), N30.1 (interstitial cystitis), M54.5 (chronic low back pain), or R10.2 (pelvic and perineal pain). Exclusion criteria included UTI diagnosis for males,

pregnant females, and patients with risk factors (i.e., urologic abnormalities, immunocompromising conditions, or poorly controlled diabetes mellitus).

The IT generated report underwent further manual review by the project members to examine whether urine analyses (UA) were performed and the subsequent UA results (presence of leukocyte esterase, nitrites, and/or blood). Next, urine cultures were investigated for microbial growth, contamination, and/or a sensitivity report. Lastly, provider data assessing clinical treatment patterns in comparison to recommended guidelines were extracted to identify timing of antibiotic prescription, antibiotic name, and duration. A primary focus of the project team was to identify cases in which antibiotics were prescribed prior to culture results, cases in which no culture and sensitive testing was performed, and if antibiotic therapy was reviewed and deemed appropriate in cases of completed culture and sensitivity testing.

Findings

Provider self-reported pre-/post-implementation survey results demonstrated an increase in providers sending a urine culture prior to prescribing empiric antibiotics from 64% to 78% (Table 2). Additionally, there was a decline in self-reported prescribing patterns indicating a perceived decrease in providing antibiotics based on patient request from 18% to 11%. Providers reported increased awareness of patient clinical condition as a consideration influencing prescribing, which is consistent with evidence-based recommendations. Prior to implementing the educational intervention, 91% of providers self-reported that they consistently follow current guidelines, however a manual chart audit was incongruent with provider assumptions/self-reporting. Post-education intervention data reflected increased provider awareness and consideration of evidence-based guidelines when prescribing antibiotics, which was supported by post-educational intervention manual chart audit findings.

Table 2

Provider Self-Reported Antibiotic Practice Pre- & Post- Survey Results

	Response – % (*n*)	
	Pre-Implementation *N*=11	Post-Implementation *N*=9
Do you revise antibiotic treatment based on urine culture results?	Yes – 100% (11)	Yes – 100% (9)
Do you send urine specimen for culture only after nonresponse?	No – 64% (7) At times – 36% (4)	No – 56% (5) At times – 11% (1) Yes – 33% (3)
Do you send urine culture before empiric antibiotics?	Yes – 64% (7) At times – 27% (3) No response – 9% (1)	Yes – 78% (7) At times – 22% (2)
Degree to which *clinical condition* influences decision to prescribe antibiotics	Major – 55% (6) Minor – 45% (5)	Major – 89% (8) Minor – 11% (1)
Degree to which *experience* influences decision to prescribe antibiotics	Major – 55% (6) Minor – 27% (3) Not at all – 18% (2)	Major – 56% (5) Minor – 33% (3) Not at all – 11% (1)
Degree to which *elimination of the infection* influences decision to prescribe antibiotics	Major – 18% (2) Minor – 55% (6) Not at all – 27% (3)	Major – 11% (1) Minor – 67% (6) Not at all – 11% (1) No response – 11% (1)
Degree to which *satisfying patients' expectation* influences decision to prescribe antibiotics	Minor – 55% (6) Not at all – 45% (5)	Minor – 56% (5) Not at all – 33% (3) No response – 11% (1)
When prescribing antibiotics for a UTI, which of the following do you consider? (Select all that apply)		
Guidelines/literature	91% (10)	78% (7)
Experience prescribing the drug	73% (8)	67% (6)
Cost	73% (8)	56% (5)
Side effect profile	73% (8)	78% (7)
Convenient dosing	45% (5)	56% (5)
Patient request	18% (2)	11% (1)
Other (Comment*)	18% (2)	–

* 2 respondents reported previous urine cultures; 1 respondent reported local sensitivity, pregnancy, systemic symptoms, other patient prescriptions, and drug interactions

Post-Intervention chart review demonstrated an increase in providers following the suggested intervention protocol with 66% of cases meeting the established criteria (see Table 3). Additionally, of those cases where protocol was not followed an increase was noted in the number of UA obtained along with a decrease in the number of antibiotics prescribed with negative culture results.

Table 3

Summary of Antibiotic Use Pre- and Post-Intervention – Chart Review

	Pre-Intervention *N*=75 Patient Charts % (*n*)	**Post-Intervention *N*=29 Patient Charts % (*n*)**
Followed Guidelines*	**40% (30)**	**66% (19)**
Did Not Follow Guidelines**	**60% (45)**	**34% (10)**
+UA but no culture & sensitivity performed	19% (14)	21% (6)
Prescribed antibiotic without urine culture	15% (11)	14% (4)
Prescribed antibiotic prior to urine culture results (but organism was sensitive to antibiotic)	21% (16)	10% (3)
Prescribed antibiotic with negative urine culture	17% (13)	3% (1)
Prescribed antibiotic without UA *and* without culture & sensitivity	5% (4)	0% (0)
Organism not sensitive to prescribed antibiotic *and* medication not changed	1% (1)	0% (0)

- Pre: (*n*=2 to Bactrim) *and* medicine was not changed (*n*=1)
- Post #1: 0 not sensitive to antibiotic
- Post #2: (*n*=1 to Cipro) changed to Amoxicillin
- Post #3: 0 not sensitive to antibiotic

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*Followed Guidelines = UA obtained, urine for culture and sensitivity sent for +UA, antibiotic prescribed after urine culture resulted, and antibiotic changed for organisms not sensitive to prescribed antibiotic. Unable to determine if severity of symptoms or cost were considered, if preventive education occurred, or if KDHE supportive measures were provided to the patient.

** Sum exceeds total % as >1 guideline may not have been followed

Note. +UA = Positive urinalysis for leukocyte esterase, nitrites, or red blood cells; post-Intervention = sum of 3 data collection periods of 11/12/21-12/10/21, 12/11/21-1/21/21, and 1/22/21-2/19/21.

Conclusion

Rurality is widely demonstrated in the literature as an independent risk factor for inappropriate prescribing. Rural providers are more-often deemed as "high prescribers" and high utilizers of broad-spectrum antibiotics. These documented practices contribute to antibiotic resistance and further complicate outcomes for patients that are already considered at-risk simply by residing within a rural community. The implications of this pilot demonstrate that a team-based approach appraising clinic processes can determine potential gaps in the provision of safe and evidence-based care. Recognition of the importance of empowering nursing professionals to not only contribute as part of teams, but to lead antibiotic stewardship initiates as content experts within rural settings is paramount to overcome the known staffing resource barriers (CDC, 2020; Health Resources and Services Administration, (n.d.). This pilot project illustrated the impact of a rural, nurse-driven interdisciplinary, antibiotic stewardship initiative that positively impacted nursing and provider prescribing patterns within a rural community.

Other contributing factors outside of providers and clinic staff must also be considered. Patients are an integral component of the change process as treatment decisions are influenced, at least in part, by patient expectations and demands. Providers and clinic staff must be prepared to

educate patients on the implications of inappropriate antibiotic usage while still addressing their presenting physical concerns. Symptom-based palliative "prescriptions", over-the-counter take-home kits, coupled with consideration of delayed antibiotics serve to offer patients tangible resources to treat symptoms in instances where antibiotics are not indicated at the initial point of patient/provider contact. Tailoring interventions specific to rural clinic needs opposed to adaptation of a more global or generic guideline approach to antibiotic stewardship programs may increase effectiveness of implementing evidence-based interventions (Ervin, et al., 2021).

Mechanisms exist to critically review processes in-place for rural facilities to improve addressing patient perceptions of the need for antibiotics to treat urinary symptoms. Although the literature reflects limitation in human resources as a common barrier to successful implementation of an antibiotic stewardship program in rural settings, this pilot demonstrates that a process-improvement-driven approach led by rural nursing professionals is impactful due to the agility of a finite workforce and limited administrative layers afforded within a rural facility.

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Conflicts of Interest

These authors declare no conflicts of interest.

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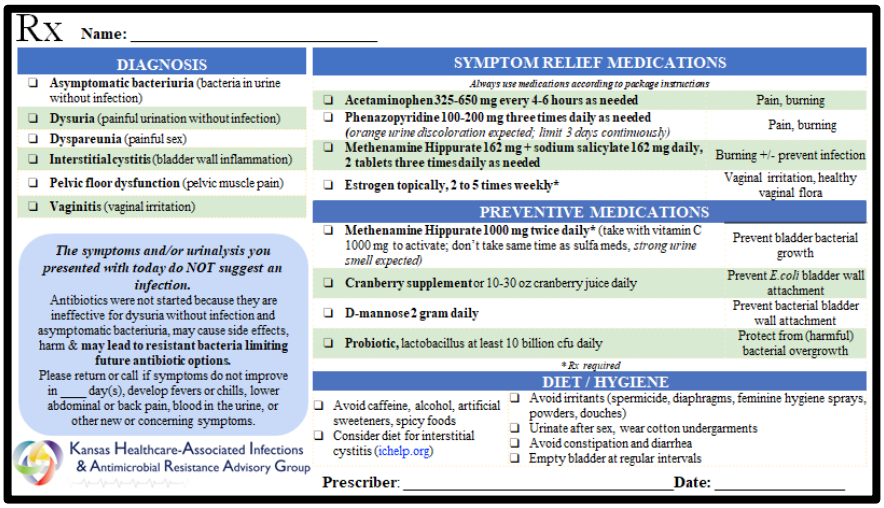
Appendix

Pilot Project Supplementary Resource

Figure 1. Take Home Symptom Relief Kit distributed to patients during this pilot project. Contents include over the counter AZO®, Tylenol®, caffeine-free tea, and a bottle of water.



Rx **Name:** _____

DIAGNOSIS

- ❑ **Asymptomatic bacteriuria** (bacteria in urine without infection)
- ❑ **Dysuria** (painful urination without infection)
- ❑ **Dyspareunia** (painful sex)
- ❑ **Interstitial cystitis** (bladder wall inflammation)
- ❑ **Pelvic floor dysfunction** (pelvic muscle pain)
- ❑ **Vaginitis** (vaginal irritation)

The symptoms and/or urinalysis you presented with today do NOT suggest an infection.

Antibiotics were not started because they are ineffective for dysuria without infection and asymptomatic bacteriuria, may cause side effects, harm & **may lead to resistant bacteria limiting future antibiotic options.**

Please return or call if symptoms do not improve in ____ day(s), develop fevers or chills, lower abdominal or back pain, blood in the urine, or other new or concerning symptoms.

Kansas Healthcare-Associated Infections & Antimicrobial Resistance Advisory Group

SYMPTOM RELIEF MEDICATIONS

Always use medications according to package instructions

❑ **Acetaminophen 325-650 mg every 4-6 hours as needed**	Pain, burning
❑ **Phenazopyridine 100-200 mg three times daily as needed** *(orange urine discoloration expected; limit 3 days continuously)*	Pain, burning
❑ **Methenamine Hippurate 162 mg + sodium salicylate 162 mg daily, 2 tablets three times daily as needed**	Burning +/- prevent infection
❑ **Estrogen topically, 2 to 5 times weekly***	Vaginal irritation, healthy vaginal flora

PREVENTIVE MEDICATIONS

❑ **Methenamine Hippurate 1000 mg twice daily*** (take with vitamin C 1000 mg to activate; don't take same time as sulfa meds, *strong urine smell expected*)	Prevent bladder bacterial growth
❑ **Cranberry supplement** or 10-30 oz cranberry juice daily	Prevent *E.coli* bladder wall attachment
❑ **D-mannose 2 gram daily**	Prevent bacterial bladder wall attachment
❑ **Probiotic,** lactobacillus at least 10 billion cfu daily	Protect from (harmful) bacterial overgrowth

**Rx required*

DIET / HYGIENE

- ❑ Avoid caffeine, alcohol, artificial sweeteners, spicy foods
- ❑ Consider diet for interstitial cystitis (ichelp.org)
- ❑ Avoid irritants (spermicide, diaphragms, feminine hygiene sprays, powders, douches)
- ❑ Urinate after sex, wear cotton undergarments
- ❑ Avoid constipation and diarrhea
- ❑ Empty bladder at regular intervals

Prescriber: _____ **Date:** _____

Figure 2. Kansas Department of Health and Environment (KDHE) "Symptom Management Rx Card", which was provided to patients as part of the Take Home Symptom Relief Kit.

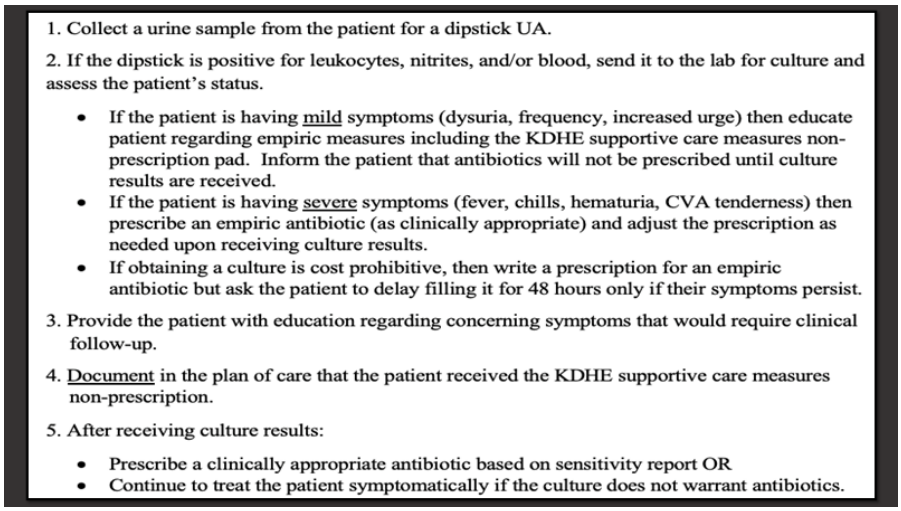


Figure 3. Step-by-step treatment protocol implemented by providers for all patients presenting with urinary symptoms.