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Antibiotic Stewardship for Asymptomatic Bacteriuria in Older Adults Residing in Long-Term Care at End-of-Life

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GW Nursing

DOCTOR OF NURSING PRACTICE PROGRAM

A DNP PROJECT

TITLE: Antibiotic Stewardship for Asymptomatic Bacteriuria in Older Adults Residing in Long-Term Care at End-of-Life

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Abstract

Background: Differentiating between asymptomatic bacteriuria (ASB) and urinary tract infections (UTIs) in older adults is challenging due to their atypical presentation. There is a critical gap in practice to adhere to clinical guidelines advising against treating ASB with antibiotics.

Objectives: The purpose of this Quality Improvement project was to implement an antibiotic stewardship program at a hospice organization to standardize judicious use of antibiotics at the end-of-life. The outcome measures were designed to evaluate clinician knowledge, prescribing policies and practice changes, the completeness of documentation, the appropriate usage of antibiotics, and clinician antibiotic use attitudes and beliefs.

Methods: Hospice clinicians were recruited using convenience sampling. A pre-post same subject and mixed-methods design was implemented for data collection and analysis. The key data collection tools were the *Agency for Healthcare Research and Quality's Suspected UTI SBAR form,* the *Antibiotic Use Attitudes and Beliefs Nursing and Provider Survey,* and the *Centers for Disease Control and Prevention's Checklist for Core Elements of Antibiotic Stewardship in Nursing Homes.* The outcomes were designed to be measured using paired t-test, chi-square tests, mean rating, descriptive statistics, and by identifying emerging themes.

Results: The baseline chart review revealed 136 prescriptions lacked the provider's indication. There was no post-intervention data to compare and perform the chi-square tests due to a lack of study participation. Six people completed the knowledge surveys. The post-test mean score (66.67 [SD = 12.91]) was not significantly higher ($p = 0.61$) than the pre-test mean score (70.83 [SD = 18.82]). Two *UTI SBAR forms* were submitted with a 100% completeness rate. A freeze

on new policy approvals prevented the project recommendations from undergoing the review process.

Conclusions: There was insufficient data to report whether the project improved the projected outcomes. The lack of study participation was attributed to the competing demands and burnout amidst the COVID-19 pandemic.

Antibiotic Stewardship for Asymptomatic Bacteriuria in Older Adults at End-of-Life

Introduction

Antibiotic resistance occurs when bacteria and fungi continue to grow despite treatment with antimicrobials. In the United States, antibiotic resistance causes nearly 3 million infections and more than 35,000 deaths annually. The Centers for Disease Control and Prevention (CDC) initially declared antibiotic resistance as one of the greatest threats to public health globally in their 2013 report, *Resistance Threats in the United States* (Antibiotic resistant threats, 2013; 2019, p. 3). Their 2019 report revealed that while antibiotic resistant-related deaths decreased by 18% since 2013, more than 12,800 people still die from *Clostridioides difficile* (*C. diff*) each year (Antibiotic resistant threats, 2019). *C. diff* is now one of five infections categorized as an urgent threat. Antibiotics can save lives when they are used to treat humans, animals, and crops, but each time they are used the risk for antibiotic resistance increases, morbidity and mortality rates rise, and healthcare costs increase (Antibiotic resistant threats, 2019). Antibiotic resistance disproportionally impacts older adults who have multiple comorbidities including physical disability, cognitive impairment, and functional incapacity (Jump et al., 2017). As a result, this age group is at high risk for infection and difficult to assess due to the atypical presentation commonly seen in older adults. In the United States, many older adults reside in a long-term care facility (LTCF) where nearly 84% of them are aged 65 and older (Lepore et al., 2020). Most older adults reside in a LTCF until the end of their life when infections are both expected and often terminal (Stone et al., 2019). On average, 47% to 79% of long-term care (LTC) residents receive an antibiotic annually and 75% of the time they are prescribed inappropriately (Hui-Chih, 2019; Morrill et al., 2016). The emerging public health threat of antibiotic resistance is a call-to-action to healthcare entities and clinicians to improve antibiotic prescribing across the health care continuum (Hui-Chih et al., 2019, p. 397).

Background and Significance

Long-term Care

More than 1.3 million people a day and more than 3 million people per year receive LTC services annually (Jump et al., 2017; Lepore, Lima, & Miller, 2020). The LTC population is estimated to reach 5.3 million by 2030 (Cohen, Choi, & Stone, 2016). LTC includes "nursing facilities, long-term care, assisted living communities, continuing care retirement communities, home care, hospice, and Program of All-Inclusive Care for the Elderly (PACE) programs" (The Society for Post-Acute and Long-Term Care Medicine, n.d., p. 1). High staff turnover rates in LTC have proven to be significant barriers to quality improvement and have been linked to poor quality care and safety outcomes, lower quality of life, and more quality care deficiencies (Kennedy, Applebaum, & Bowblis, 2020). Nurses (registered and licensed practical nurses) report to nurse practitioners (NP) and physicians who spend more time off site and have more competing priorities than providers in acute and primary care settings (Beeber et al., 2020). Diagnostic testing resources, laboratories, and imaging studies are not always immediately accessible (Jump et al., 2017). As such, the goals of care, strategies, resources, and staffing requirements are unique to the LTC setting (Jump et al., 2017).

Antibiotic Stewardship

Antibiotic stewardship is an evidence-based, cost-effective solution for long-term care organizations to improve antibiotic resistance and patient safety at the end-of-life (EOL) (Morrill et al., 2016). Stewardship endorses the appropriate diagnosis, drug, dose, and duration of antibiotics. The primary goal is to optimize clinical outcomes and reduced preventable consequences. While the clinical staff and provider are tasked with making an appropriate

diagnosis, antibiotic stewardship is distinct from infection control. Therefore, antibiotic stewardship requires a pharmacist or physician trained in antimicrobial therapy to help providers optimize drug selection, dosing strategy, and duration of treatment (Morrill et al., 2016, p. 183.e1). The Centers for Medicare and Medicaid Services (CMS) published their Final Rule in 2016, mandating antibiotic stewardship in LTCFs. Specifically, CMS requires them to designate at least one Infection Preventionist, and to adopt policies and procedures to identify and monitor antibiotic usage as part of their infection prevention and control program (Cooper, 2020, p. 3). It costs Medicare and Medicaid an average of $30 billion for skilled nursing and $51 billion for nursing facility services per fiscal year in contrast to the $55,000 it costs LTCFs to maintain an antibiotic stewardship program annually (Centers for Medicare & Medicaid Services, 2016b). While several antimicrobial stewardship programs in LTCFs have been adapted from the acute care setting, there is a paucity of data on economic models of infection prevention and the specific strategies to overcome the unique challenges in LTC (Cohen et al., 2016); Hui-Chih et al., 2019; Morrill et al., 2016).

Asymptomatic Bacteriuria

Asymptomatic bacteriuria (ASB) is the presence of bacterial colonization of the urinary tract, which may include a positive urinalysis and urine culture, without localized genitourinary symptoms (Hui-Chih, 2019; Morrill et al., 2016). Differentiating between asymptomatic bacteriuria (ASB) and urinary tract infections (UTIs) is difficult to due to the widespread presence of asymptomatic bacterial colonization in 50% of LTC residents (Jones et al., 2017; Morrill et al., 2016; Politis & File, 2019). Differentiating ASB from UTIs are challenging due to poorly defined diagnostic criteria, and prioritization of laboratory results over clinical presentation. Additionally, the limited guidance on the interpretation of diagnostic tests,

identification of ASB in older adults with dementia, when to order urine cultures, and selection of appropriate empiric treatment has led to delays diagnosis and treatment (Claeys et al., 2019; Cortes-Penfield et al., 2017). Consequently, older adults are often inappropriately treated for ASB in the setting of cognitive and physical impairments or following a fall (Hui-Chih, 2019). The treatment of ASB has not decreased the risk for recolonization, the frequency of symptoms, or morbidity and mortality rates (Avelluto & Bryman, 2018; Morrill et al., 2016). Instead, it has been well documented that inappropriate antimicrobial prescribing has led to the increased prevalence of antimicrobial resistance amongst older adults, a higher rate of *C. diff* infections, additional health care expenses, and negative side effects on metabolism, digestion, and immunity (Cortes-Penfield et al., 2017; Politis & File, 2019). Furthermore, it has led to delays in making an accurate diagnosis and initiating proper treatment (Politis & File, 2019).

Urinary Tract Infections

UTIs account for nearly 7 million office visits, 1 million emergency room visits, and 100,000 hospitalizations in about 25% of older adults (Cortes-Penfield et al., 2017, p. 673). The majority (more than 80%) of UTIs occur in women and most women (over 50%) will develop a UTI at least once, 25% will experience a reoccurrence, and 5% will develop chronic recurrent UTIs (Gaitonde, Malik, & Zimmern, 2019). The annual average cost of healthcare-associated infections (HAI) ranges from $38 to $137 million for antimicrobials and $637 to $2 billion for hospitalizations. The average cost of prophylactic antibiotics is $4 to $28; an uncomplicated UTI (includes testing and antibiotic treatment) is $40, and an antibiotic resistant UTI is about $200 (Wang, Hacker, & Lefevre, 2020). An insufficient amount of attention has been given to patient out-of-pocket costs for medical care and long-term care services at EOL. As a result, these patients and their families are burdened with the cost of care which is greatest the last two years

of life (Willink et al., 2019). Merging the goal of palliation and infection management is part of a new concept called integration (Stone et al. 2019). It includes early advanced-care planning (ACP) for EOL care (including antibiotic preferences) which has led to increased quality of life, patient satisfaction, and decreased costs to patients, caregivers, and the healthcare system at large (Sonenberg and Sepulveda-Pacsi, 2018; Stone et al., 2019).

Nurse Engagement

In a white paper published by the American Nurses Association and the Centers for Disease Control and Prevention (CDC), health care entities are encouraged to engage nurses in front-line antibiotic stewardship efforts. Nurses are at the hub of communication between patients, families, and stakeholders. Their central role in the community and long history of being the most trusted profession, makes them ideal educators, advocates, and ambassadors for judicious usage of antibiotics (American Nurses Association and the Centers for Disease Control and Prevention Workgroup, 2017). NPs are incentivized by Medicare to have discussions about ACP which is the recommended time to educate residents and families about antibiotic stewardship and to identify their wishes for EOL infection management (Advanced care planning, 2020). Nurse executives are ideally positioned to spearhead strategic nursing engagement in antibiotic stewardship interventions organization wide. Nurses of every level are encouraged to fulfill their professional obligation to inform patients about EOL care options and participate in antibiotic stewardship efforts (Sonenberg & Sepulveda-Pacsi, 2018).

Needs Assessment

A needs assessment was conducted for a hospice organization in the District of Columbia Metropolitan Area. The demand for their services correlates with the growing number of older

adults who have difficulty accessing traditional healthcare services due to chronic illness or mobility issues. Moving forward, they will need to design a more competitive compensation package for employees, guarantee stricter infection control policies and adequate safety equipment, and work with other community-based organizations to mitigate the negative effects of COVID-19 on social determinants of health. To help providers meet the complex needs of a growing older adult population and community recovering from the pandemic, they will need to offer more virtual training opportunities, and decision-making aids to help clinicians adhere to evidence-based clinical guidelines while ensuring high quality care that is personalized, engaging, and affordable (see Appendix A).

Problem Statement

Differentiating between ASB and UTIs remains challenging for clinicians treating older adults, especially for those with cognitive impairment, following a fall, or at the end-of-life. A review of antibiotic prescribing practices at a hospice organization in the District of Columbia Metropolitan Area revealed providers treating hospice patients may find it beneficial to receive education and then utilize the templates and guidelines recommended by the Society for Post-Acute and Long-Term Care Medicine (AMDA), the Centers for Disease Control and Prevention (CDC), and the Agency for Healthcare Quality and Research (AHRQ) to standardize judicious use of antibiotics at the EOL (Antibiotic stewardship for nursing homes, 2020; Jump et al., 2017; Toolkits, 2017).

Currently, there is no standardized practice for determining when to prescribe antibiotics at the EOL. Instead, providers prescribe antibiotics for asymptomatic bacteriuria based on the assessment skills of the nursing staff or at the request of the family. The Infectious Diseases

Society of America's (IDSA) 2019 clinical guidelines advise clinicians not to treat ASB with antibiotics, but there remains a critical gap in practice to adhere to these guidelines (Cortes-Penfield et al., 2017; Politis & File, 2019). "The integration of palliative care and infection management can help reduce burdensome treatments and improve quality of care for residents at the end-of-life" (Tark et al., 2020, p. 580). Therefore, an antibiotic stewardship program will be initiated to standardize clinical assessment documentation, communication, and antibiotic usage for asymptomatic bacteriuria for hospice patients throughout the organization.

Aims

The purpose of this quality improvement project is to implement an antibiotic stewardship program with the aim of improving the completeness of clinical assessment documentation, appropriate prescribing of antibiotics for asymptomatic bacteriuria, antibiotic stewardship policies and practice changes, clinician attitude and beliefs about antibiotic usage, and the education of clinicians on the criteria for appropriate antibiotic treatment of urinary tract infections.

Objectives

Outcome Measures

The measures for this project will encompass structure, process, outcome, and balancing measures (see Appendix B). The knowledge measure will evaluate the increase in clinician knowledge of antibiotic stewardship for urinary tract infections. The structure measure will evaluate the increase in the number of prescribing policies and practice changes to support antibiotic stewardship. The process measure will evaluate the completeness of clinical assessment documentation. The outcome measure will evaluate the decrease in the percentage of

inappropriate antibiotics initiated for hospice patients with asymptomatic bacteriuria. The balance measure will evaluate provider and nurse antibiotic use attitudes and beliefs.

Review of Literature

Search Strategy

A research librarian was consulted to conduct a search with high precision and accuracy during October 2020. Articles were selected from the PubMed, Ovid MEDLINE, and retrieved by hand searches during manual cross-referencing for eligible articles. During the screening process, the title, abstract, methods, and results sections were analyzed based on the inclusion and exclusion criteria. The selected articles were stored and screened for duplicates using EndNote. In PubMed, the keywords "nursing home" and the Medical Subject Heading (MeSH) term for "nursing home" were combined using the Boolean operator "or". Then, the MeSH terms for "urinary tract infection" and "bacteriuria" which were combined using the Boolean operator "or". Finally, the MeSH term for "antimicrobial stewardship" was added to the Query where all the final results from the previous searches were joined using the Boolean operator "and".

In MEDLINE, the keywords "antimicrobial stewardship", "antibiotic stewardship", "long term care", "nursing home", "health professional", and "nurse*" were combined with their MeSH term using the Boolean operator "or". Then, the MeSH terms for "urinary tract infection" and "bacteriuria" were combined using the Boolean operator "or". Finally, the yield from both searches were combined using the Boolean operator "and". Limits applied to the search were articles written in the English language and published between 2015 and to March 2021.

Inclusion and Exclusion Criteria

Meta-analysis, systematic reviews, randomized control trials, quasi-experiments, quantitative, qualitative, and pre- and post-studies met the inclusion criteria. Studies with men

and women aged 65 years and older, written in English, published in the last six years, and that reported on antibiotic prescribing rates, urinary tract infection rates, process measures, infection management for end-of-life patients, and/or provider knowledge measures in long-term care facilities were included. A total 69 articles were identified using PubMed and MEDLINE, and 10 articles were identified using manual cross-referencing. Six duplicate articles were removed and 46 were excluded during the initial screening process. Twenty-seven full-text articles were assessed for inclusion eligibility. Ten articles were included: Doernberg et al., 2015; Hui-Chih et al., 2019; Lee et al., 2018; McMaughan et al., 2016; Morrill et al., 2016; Morioka et al, 2020; Nace et al., 2020; Ramly et al., 2020; Scales et al., 2017; Tark et al., 2020.

Studies were excluded if they were cohorts, case reports, expert opinion, included animals and were not published in English. Studies were also excluded if the sample population was younger than 65 years of age, pregnant, a kidney transplant recipient, on antibiotics prior to the intervention, or had a recent or current urologic procedure. A total of 10 articles were excluded because they took place entirely in an acute care setting, did not include antibiotic stewardship as the primary intervention, did not report clinical outcomes, and were an ongoing study at the time of publication (see Appendix C).

Quality Appraisal Tool

The Johns Hopkins Nursing Evidence-Based Practice Model (JHNEBP) Research and Nonresearch Evidence Appraisal Tools were used to critically appraise the strengths and weaknesses of the studies. The Research Evidence Appraisal Tool contains several questions to help the data abstractor determine the level of meta-analysis (Level I), experimental studies (Level 1), quasi-experimental studies (Level II), nonexperimental and qualitative studies, and meta-syntheses (Level III). It contains a broadly defined quality rating scale that allows the data

abstractor(s) to apply both structure and critical-thinking skills to determine if/how the evidence informs their practice. Quality is graded as high, good, or low quality/major flaws based on the consistency, generalizability, sample size, degree of control, definitive conclusions, and reference to scientific evidence. Level I and high-quality studies represent the highest strength of evidence which are more likely to represent the best practices (Dearholt and Dang, 2016, Appendix E). The Nonresearch Evidence Appraisal Tool contains several questions to help the data abstractor determine the level (Level IV or V) of summaries of evidence, organizational experience, expert opinion, community standards, clinical experience, and consumer preferences. Quality is graded as high, good, or low quality/major flaws based on the official sponsor of the study, literature review strategy, evaluation of the strength and limitations, consistency of the results, the number of well-designed studies, and the definitive conclusions (Dearholt and Dang, 2016, Appendix F).

Synthesis of the Findings

The purpose of the literature review was to identify evidence-based strategies to 1) improve the completeness of clinical assessment documentation for suspected UTIs, 2) decrease the number of inappropriate antibiotic prescriptions that fail to meet the criteria, 3) decrease the percentage of adverse drug events related to antibiotics for asymptomatic bacteriuria (ASB), 4) improve the documentation of patient antibiotic preferences for EOL care, 5) achieve provider satisfaction for UTI decision support tools, 6) improve education provided to patients and caregivers on high-risk medications during initiation of antibiotics, and 7) increase the number of prescribing policies and practice changes to support antibiotic stewardship.

A synthesis of the evidence revealed a multifaceted approach is the most pragmatic and cost-effective strategy to improving antibiotic prescribing practices for asymptomatic bacteriuria.

LTCFs that implemented web-based training, frequent follow-up after education, decision-making aids, pocket guides, posters, and promotional materials observed a modest decrease in antibiotic utilization regardless of the study design (Lee et al., 2018; McMaughan et al., 2016; Morrill et al., 2016; Nace et al., 2020). (Doernberg et al., 2015; Hui-Chih et al., 2019). When providers were given antibiotic stewardship tools in combination with education sessions, they improved both their empiric treatment of suspected UTIs and prescribing practices in accordance with McGeer and Loeb Criteria (Loeb et al., 2001; Morrill et al., 2016). Furthermore, they ordered fewer urine cultures for suspected UTIs and were five times less likely to order antibiotics for asymptomatic bacteriuria (Lee et al., 2018; McMaughan et al., 2016). To promote practice changes that support antibiotic stewardship, some LTCFs dedicated a pharmacist or physician trained in antimicrobial therapy to help providers optimize drug selection, dosing strategy, and duration of treatment (Morrill et al., 2016, p. 183.e1). Pharmacist-led educational interventions and audit-feedback targeting providers' individual prescribing habits yielded the most positive outcomes by increasing provider knowledge about when to discontinue, streamline, or shorten the course of therapy (Doernberg et al., 2015; Hui-Chih et al., 2019; Morrill et al., 2016).

A multifaceted approach was also the best strategy to improve clinician attitude towards antibiotic stewardship for asymptomatic bacteriuria. Insufficient education was the leading cause of inappropriate use of antibiotics for ASB. While educating providers reduced the gap in knowledge about clinical guidelines and educating residents and families reduced the pressure provider's felt to prescribe antibiotics for ASB, education alone was insufficient to improve sustainability efforts (Hui-Chih et al., 2019; Lee et al., 2018; Morrill et al., 2016; Nace et al., 2020; Scales et al., 2017). A thematic analysis revealed the three main barriers to improving

clinician attitude were nurse and provider education, structured information tools, and organizational improvement. LTCFs would need tools to improve nurse assessment reporting, to identify provider needs and increase their accessibility, and to increase provider confidence in nurses' assessment and nurses' confidence in communicating recommendations to overcome these barriers (Ramly et al., 2020). Palliative and hospice trained providers were found to be the best to lead stewardship efforts and to address the potential medical and legal risks associated with withholding antibiotics to improve clinician attitude towards antibiotic stewardship for EOL patients specifically (Scales et al., 2017).

When it came to improving the documentation of antibiotic preferences at EOL, Tark et al. (2020) reported most LTCFs did not have "do not administer antibiotic" orders and most providers did not use shared decision making when managing EOL infections nor initiate the conversation until after an adverse event. Family preferences were more likely to be elicited following a change in condition and less likely during admission or goals of care. When families did participate in decision-making, they were more likely to request antibiotics than residents and subsequently, antibiotic usage increased (Morrill et al., 2016; Tark et al., 2020). The evidence revealed providers have a diverse and equivocal attitude towards EOL care. Their backgrounds, beliefs and perceptions influence their management of infectious disease at EOL (Morioka et al., 2020). None of the studies reported on the completeness of clinical documentation at the time of assessment prior to contacting the provider. This outcome was not measured nor reported due to limited LTCF resources, reliance on self-reporting by clinicians, and efforts to streamline data collection (Morrill et al., 2016; Nace et al., 2020).

The aim of CMSs mandate for LTCFs to adopt an ASP was to reduce the threat of antibiotic resistance in the community, reduce hospital admissions, and improve the quality of

care for residents in LTCFs (Centers for Medicare and Medicaid, 2016a; Hui-Chih et al., 2019; Morrill et al., 2016). In response, some LTCFs provided diagnostic and treatment algorithms for UTIs in combination with small group education sessions for nurses, videotapes, written materials, outreach, and physician interviews to decrease the percentage of adverse drug events related to antibiotics prescribed for ASB. Those interventions did not significantly decrease mortality rates or hospital admissions (Morrill et al., 2016). A randomized control trial by Nace et al. (2020) used a multifaceted approach that included standardized physician order sets for suspected UTIs, audit-feedback, and coaching. The study revealed the rates for *C. diff* increased in the control group and remained stable in the intervention group where the baseline-adjusted reduction was 65% (p. 947).

Limitations

The barriers to implementing an ASP included both intrinsic (attitude, knowledge, and behavior) and extrinsic (individual situation, clinical setting, and cultural variables) factors (Scales et al., 2017). It was difficult to establish rapport, secure buy-in, and optimize stewardship education with providers due to the limited face-to-face interactions in the LTC setting (Doernberg et al., 2015; Morrill et al., 2016). Most studies relied on convenience sampling and self-reports which led to high risk of bias. Few studies evaluated pre- or post-education knowledge or satisfaction to identify specific barriers to utilizing UTI decision-making tools. Implementing too many interventions at once limited the ability to evaluate the efficacy or effectiveness of individual components (Hui-Chih et al., 2019; Morrill et al., 2016). There were a limited number of studies with access to antibiotic prescription data or antibiotic usage which limited findings on effective strategies to decrease the number of inappropriate antibiotic prescriptions. The limited number of validated quality appraisal tools in the LTC

setting made it difficult to standardized strategies, evaluation, or reporting methods. Few studies included residents with ASB not treated with antibiotics which made it difficult to distinguish between improved documentation and improved prescribing practices. Lastly, there was a paucity of data on studies that integrated palliative care and infection management for EOL residents which limited comparative analysis.

Evidence-Based Practice Translation Model

The Johns Hopkins Evidence-Based Practice Model (JHEBPM) served as the guide to translate evidence into practice and determine the DNP Project timeline. The utilization of an evidence-based model was chosen to help the hospice organization foster end-user adoption of evidence, encourage participants to speak a common language, standardize practice changes, and embed the proposed interventions into the systematic structure of the organization (Dearholt & Dang, 2018, p. 36). The JHEBPM includes three essential components, inquiry, practice, and learning. Inquiry is the first and most important step and it starts with asking a question. Nursing practice is founded on the spirit of inquiry where curiosity challenges existing practice and seeks innovative, evidence-based solutions to guide clinical decision-making. Nursing practice has traditionally been based on policies, protocols, procedures, and broad national standards. Organizations are now expected to standardize their practices based on the latest evidence to deliver consistent, high quality, and safe patient care at a lower cost (Dearholt & Dang, 2018; Triple Aim for Populations, 2021). The model encourages a learning culture where staff are inspired to ask questions, increase their knowledge, and improve their skills. Separate from formal education, a desire for learning helps drive quality improvement in patient outcomes. Ongoing learning includes interprofessional learning which prepares teams to solve problems. The JHEBPM includes 19-steps that are divided into three phases known as the PET Process:

practice questions, evidence, and translation. The PET Process outlines a systematic approach to solve a practice question, identify the best evidence, and use the best data to translate evidence into practice (Dearholt & Dang, 2018).

PICO Question

For clinicians who care for hospice patients aged 65 and older (P), does the implementation of an antimicrobial stewardship tool (I) in comparison to not using an antimicrobial stewardship tool (C) change antibiotic prescribing practices and clinician attitude and beliefs about antibiotic usage (O).

Project Design

A quality improvement Doctor of Nursing Practice (DNP) Project was designed to improve the antibiotic treatment of asymptomatic bacteriuria in older adults at the EOL. Moran, Burson, and Conrad (2019) define quality improvement as "the systematic collection and analysis of data to measure change, with growing emphasis on rapid cycle change" (p. 161). DNP graduates are expected to competently implement QI projects which make data-driven contributions to speed up the translation of evidence into practice in a variety of clinical and non-clinical settings using innovative, effective, and efficient strategies.

Methods

Study Aims

The aim was to improve the completeness of clinical assessment documentation, appropriate prescribing of antibiotics for ASB, antibiotic stewardship policies and practice changes, clinician attitude and beliefs about antibiotic usage, and the education of clinicians on the criteria for appropriate antibiotic treatment of urinary tract infections (UTIs).

Analysis Plan

Improve the Completeness of Clinical Assessment Documentation

- Registered nurse (RN) case managers were asked to document the Situation, Background, Assessment, and Request for Orders on the Agency for Healthcare Research and Quality (AHRQ) *Suspected UTI SBAR form (*Agency for Healthcare Research and Quality, 2014). The plan was to have participants submit the *UTI SBAR forms* electronically and have the Principal Investigator (PI) analyze them bi-weekly. The plan was to use REDCap to evaluate completeness of documentation (yes or no) and trends in data collection. The percentage of missing data was analyzed using descriptive statistics.

Improve Appropriate Prescribing of Antibiotics for Asymptomatic Bacteriuria

- Three months of baseline data on the number of antibiotics prescribed for hospice patients with asymptomatic bacteriuria was obtained by conducting a chart review. The plan was to code the data by documenting the number of times antibiotics were prescribed for a suspected urinary tract infection and genitourinary symptoms were present. The plan was to analyze the data by calculating the percentage of yes and no responses and use chi-square tests (χ^2 test) to compare the pre- and post-intervention groups.

Increase the Number of Antibiotic Stewardship Policies and Practice Changes

- The number of prescribing policies and practice changes to support antibiotic stewardship was measured using the five categories of the *Centers for Disease Control and Prevention's Checklist for Core Elements of Antibiotic Stewardship in Nursing Homes* (Antibiotic stewardship for nursing homes: Checklist, 2020). Each of the five categories

was counted as 20%. The numerator was the number of core elements in writing and the denominator was 100%.

Improve Clinician Attitude and Beliefs about Antibiotic Usage

- Following the intervention period, the plan was to have participants complete an electronic version of the *Antibiotic Use Attitudes and Beliefs Nursing and Provider Survey* (Nursing and Provider Antibiotic Use Attitudes and Beliefs Survey, n.d.). The plan was to analyze the data by calculating the frequency and percentages of the responses and use McNemar's test as appropriate. The plan was to analyze qualitative data to identify emerging themes.

Improve the Education of Clinicians on the Criteria for Appropriate Antibiotic Treatment

- The plan was to have participants answer the same 4 questions before and after the PI presented the web-based educational module. The plan was to analyze the data from the pre-test and post-test knowledge questionnaires by calculating the mean and use a paired t-test to compare the different responses before and after the web-based training session.

Study Alignment of Aims and Outcomes

As seen in Appendix D, the first aim, to improve the completeness of clinical assessment documentation, aligned with the process measure to evaluate the completeness of clinical assessment documentation. It was supposed to be measured by evaluating RN case managers' documentation of their full assessment for hospice patients suspected to have a UTI. Complete documentation included the Situation, Background, Assessment, and Request for orders on the *Suspected UTI SBAR form*. See Appendix E. A critical component of the project's success was the RN case managers utilization of the *Suspected UTI SBAR form*. The goal was to use a decision-making tool like the *Suspected UTI SBAR form* to help clinicians identify key

assessment data needed to differentiate symptomatic and asymptomatic bacteriuria. This was an important step to support antibiotic stewardship efforts. The assessment data on the form was supposed to be shared with the prescribing hospice physician or nurse practitioner to communicate whether the symptoms met the minimum Loeb criteria for a UTI and the guidelines for initiating an antibiotic. It could have also been used to educate residents and caregivers about antibiotic stewardship, the primary request of study participants. The final diagnosis and treatment would ultimately be left to the discretion of the prescribing clinician based on the patient's wishes. The aim was to help to standardize documentation and communication to support efficient, consistent, and patient-centered care. The long-term goal was to have the organization adopt the *Suspected UTI SBAR form* or a similar decision-making tool organization wide to support antibiotic stewardship in accordance with the latest guidelines.

The second aim, to improve appropriate prescribing of antibiotics for asymptomatic bacteriuria, aligned with the outcome measure to decrease the percentage of inappropriate antibiotics initiated for hospice patients with asymptomatic bacteriuria. It was supposed to be measured by comparing the 3-month baseline percentage of antibiotics prescribed for suspected UTIs to the percentage of antibiotics prescribed for suspected UTIs during the intervention period. The goal was to have the *UTI SBAR form* capture both the assessment data and prescription data in one place to support the antibiotic surveillance component of stewardship. The AHRQ provides access to the Word and PDF version of the *UTI SBAR form*. The PI created an electronic fillable version using Microsoft Forms that was compatible with the Microsoft SharePoint Server utilized by the organization to store frequently used documents. The aim was to have the form easily accessible and seamlessly incorporated into the RN case manager's

clinical workflow to increase adoption. The electronic version could have also improved data pooling and analysis of indications for antibiotic prescriptions which was currently not available.

The third aim, to improve antibiotic stewardship policies and practice changes, aligned with the structure measure to increase the number of prescribing polices and practice changes to support antibiotic stewardship. It was measured by using the *Centers for Disease Control and Prevention's Checklist for Core Elements of Antibiotic Stewardship in Nursing Homes* as a guide to calculate the percentage of core elements in place that 1) standardize diagnostic criteria for urinary tract infections; 2) improve the appropriate selection, dose, and duration of antibiotic treatment; 3) promote pharmacists' oversight, 4) encourage utilization of standardized assessment and communication tools; and 5) define stewardship related duties for clinical leaders. The aim was to have at least two of the project interventions/recommendations adopted by the stakeholders. Specifically, the two recommendations included a policy or written protocol to support and promote the utilization of a standardized tool for assessment and diagnostic criteria for UTIs using Loeb Minimum Criteria, revised McGeer Criteria, or an evidence-based protocol developed by the organization. Second, a policy or written protocol that described the therapeutic decisions for diagnostic criteria, diagnostic testing, and antibiotic prescribing (to include dose, route, and duration) based on the latest guidelines for older adults (Jump et al., 2017).

The fourth aim, to improve clinician attitude and beliefs about antibiotic usage, aligned with the balance measure to evaluate provider and nurse antibiotic use attitudes and beliefs. It was supposed to be measured by calculating the frequency and percentages of the responses on the *Antibiotic Use Attitudes and Beliefs Nursing and Provider Survey*. The aim was to use the

responses to craft recommendations to the stakeholders regarding the facilitators and barriers to clinician adoption of antibiotic stewardship efforts.

The fifth aim, to improve the education of clinicians on the criteria for appropriate antibiotic treatment of UTIs, aligned with the knowledge measure to increase clinician knowledge of antibiotic stewardship for UTIs. It was measured by comparing the responses from a pre-test and post-test knowledge survey that included the same four questions. It included a combination of multiple choice and true and false questions. The pre-test and post-test were administered before and after the virtual education session where the PI presented the web-based education module, *The Complicated Nature of Urinary Tract Infection Diagnosis and Potential Role of Diagnostic Stewardship in Long-Term Care* PowerPoint, developed by the University of Maryland's School of Medicine (with their permission) (Leekha, 2019). The aim was to see an improvement in responses that addressed the baseline understanding of the definition for ASB, risk factors for ASB, the effect of treating ASB with antibiotics, and nursing assessment for suspected UTIs.

Program Development

The antibiotic stewardship program was developed using the templates and guidelines recommended by the Society for Post-Acute and Long-Term Care Medicine (AMDA), the Centers for Disease Control and Prevention (CDC), and the Agency for Healthcare Quality and Research (AHRQ) (Antibiotic stewardship for nursing homes: Checklist, 2020), 2020; Jump et al., 2017; Toolkits, 2017). The templates were published for long-term care organizations to use to assist with the development, implementation, and surveillance of antibiotic stewardship interventions. Hospice clinicians were recruited to participate in the12-week intervention.

Data Collection Tools

Prior to the intervention, baseline data on the number of antibiotics prescribed for hospice patients was obtained by conducting a chart review of the previous 3-months (July – September) with the assistance of the hospice pharmacists. The data was stored in Excel and used to make final recommendations for standardized practice. During the virtual education session, participants answered the same 4 pre-test and post-test knowledge survey questions. Participants received a REDCap link to the pre-test. Upon completion, they were automatically directed to *The Complicated Nature of Urinary Tract Infection Diagnosis and Potential Role of Diagnostic Stewardship in Long-Term Care* 42-slide educational module presented by the PI. The post-test questions automatically appeared below the PowerPoint in REDCap. Survey percentage scores were stored in Microsoft Excel. REDCap data was exported into SPSS, the Statistical Package for the Social Sciences Software.

During the intervention period, the RN case managers were asked to fill in the four sections on the *Suspected UTI SBAR forms* including, the Situation, Background, Assessment, and Request for orders. The 'R' in SBAR was modified from 'recommendation' to 'request' to meet the needs of long-term care clinicians. The request section included a space for the nurse to document if antibiotics were prescribed, the name, dose, route, and duration. The *Suspected UTI SBAR form* was modified to include an option for the nurse to document if antibiotic stewardship education was provided to the resident and/or caregiver. Patient demographics were not documented, instead a numerical identifier was assigned to each patient in the chronological order in which the SBAR forms were submitted to evaluate trends during the intervention period. The Microsoft Form was designed to automatically have all forms emailed to the second DNP

advisor who reviewed them for Health Insurance Portability and Accountability (HIPAA) compliance prior to submitting them to the PI for data analysis.

Following the intervention period, participants were supposed to attend another virtual session to answer the 15-minute questionnaire for the *Antibiotic Use Attitudes and Beliefs Nursing and Provider Survey*. The survey was developed by the Minnesota Health Department who granted permission to use their materials. The survey was supposed to be administered electronically using REDCap. Respondents were supposed to select answers that ranged from rarely to often, disagree to agree, and true or false. Additionally, there was a clinical scenario with multiple-choice questions. The only demographic data that would have been required was clinician title and years of practice.

Software Utilized

All the resources used during the project were sent or presented electronically. Each participant was required to have access to a computer with internet. Gmail, the organization's secure internal email server, Microsoft Word, and Excel were utilized to conduct correspondence with the antibiotic steward committee members and study participants, to create information packets, to store data, and perform calculations. Microsoft Forms was used to create an electronic version of the *Agency for Healthcare Research and Quality's Suspected UTI SBAR form* which was uploaded to the hospice organization's Microsoft SharePoint Server. Zoom, a secure web-based video application, was used to conduct antibiotic stewardship committee meetings, to conduct the virtual education session, and was used to present study findings to stakeholders. REDCap, a secure web application, was used to manage the web-based surveys, the master list of participant identification numbers, databases, and the data coding scheme. The Statistical Package for the Social Sciences (SPSS) Software was used to run statistical analysis.

Data Entry Accuracy

The PI was the sole data manager and evaluator to assure data accuracy and reduce the introduction of interrater reliability which had the potential to threaten the consistency of data analysis (Siedlecki, & Albert, 2017). The final data calculations were completed three times to assure accuracy of the evaluations.

Maintenance and Security

Data collection and analysis were conducted on a password protected computer accessible only to the PI. The *Suspected UTI SBAR forms* were designed to code each patient as patient 1, patient 2, patient 3 and so forth to maintain confidentiality. To prevent any HIPAA violations, the second DNP advisor reviewed each *Suspected UTI SBAR form* for personal health information prior to emailing them to the PI. The pre-test and post-test knowledge surveys were coded using a numerical value which was assigned in chronological order of completion and aggregated based on the different clinical roles.

Recruitment and Characteristics of Participants

The PI and second DNP Advisor recruited eligible clinicians using convenience sampling. Inclusion criteria included any physician, nurse practitioner, registered nurse (RN), or licensed practical nurse (LPN) directly involved in the assessment, diagnosis, and/or treatment of home hospice patients at the start of the intervention period. Exclusion criteria included anyone hired or transferred into the study neighborhood after implementation and those who opted out of participation. Clinicians' identity and demographic data remained anonymous to maintain confidentiality and encourage transparency amongst a small staff. Project participation was completely voluntary as discussed in the consent.

Results

A quality improvement (QI) DNP Project was designed to implement an antibiotic stewardship program at a long-term care organization in the District of Columbia Metropolitan Area. The primary goal was to standardize judicious use of antibiotics for asymptomatic bacteriuria in older adults at the end-of-life.

Data Analysis

To evaluate how well the project improved the appropriate prescribing of antibiotics for asymptomatic bacteriuria, the data was supposed to be analyzed by calculating the percentage of yes and no responses and using chi-square tests (χ^2 test) to compare the pre- and post-intervention prescription data. Antibiotic prescription data was coded based on the number of times antibiotics were prescribed for a suspected urinary tract infection and genitourinary symptoms were present (yes) or absent (no) utilizing 2 for yes, 1 for no, and 0 for unknown or no answer to account for data. The chart review revealed the pharmacists' software had the functionality to separate antibiotic prescriptions but lacked the provider's indication for the prescription. The 136 prescriptions included a total of 13 different antibiotics. The hospice physicians and nurse practitioners were emailed the list and asked which antibiotics they were most likely to prescribe for suspected and/or confirmed UTIs based on their usual prescribing practices. A final list of five antibiotics were identified as the most prescribed to treat suspected and/or confirmed UTIs for hospice patients according to the providers who responded to the email. Appendix F, Table 3 shows that each antibiotic was coded as 0 to indicate it was unknown whether genitourinary symptoms were present. There was no post-intervention data to compare and perform the chi-square tests due to the lack of study participation due to the impacts of COVID-19. Therefore, there is insufficient data to report whether the project improved the

appropriate prescribing of antibiotics for asymptomatic bacteriuria in older adults residing in long-term care at the end-of-life.

To evaluate how well the project improved education of clinicians on the criteria for appropriate antibiotic treatment of UTIs, the knowledge questionnaire was administered as a pre-test and post-test. Survey data was analyzed by calculating the mean and using a paired t-test to compare the different responses before and after the web-based training session. Thirteen clinicians attended the virtual education session, only 6 people completed both the pre-test and post-test knowledge surveys. Appendix G, Table 4 shows the pre-test and post-test scores including missing data. Appendix H, Table 5 shows, the post-test mean score of 30.77 (SD = 35.59) was significantly lower ($p = 0.16$) than the pre-test mean score of 57.69 (SD = 29.55). Appendix I, Table 6 shows the pre-test and post-test scores with the missing data excluded ($n = 6$). Appendix J, Table 7 shows the post-test mean score of 66.67 (SD = 12.91) was not significantly lower ($p = 0.61$) than the pre-test mean score of 70.83 (SD = 18.82). Therefore, the educational module did not improve clinician education on the criteria for the appropriate antibiotic treatment of UTIs.

To evaluate how well the project improved the completeness of clinical assessment documentation, the intervention data was analyzed by calculating the percentage of yes and no responses. Microsoft Excel was used to document whether the *Suspected UTI SBAR forms* were completed using utilizing 2 for yes, 1 for no, and 0 for missing data. Appendix K, Table 8 shows only 2 *UTI SBAR forms* were submitted during the 12-week intervention with a 100% completeness rate. The lack of study participation was attributed to the competing demands and burnout amidst COVID-19. There was insufficient data to report whether the project improved completeness of clinical assessment documentation during the 12-week intervention.

To evaluate how well the project improved clinician attitude and beliefs about antibiotic usage, data from the *Antibiotic Use Attitudes and Beliefs Nursing and Provider Survey* was supposed be analyzed by calculating the frequency and percentages and using McNemar's test as appropriate. Qualitative data was going to be analyzed to identify emerging themes. Appendix L, Table 9 shows no data was collected. The follow-up Zoom session with study participants after the intervention was not able to take place due to the competing demands of COVID-19 which negatively limited study participation. Therefore, there was insufficient data to report whether the project improved clinician attitude and beliefs about antibiotic usage.

To evaluate how well the project improved antibiotic stewardship policies and practice changes, the data was measured by using the *Centers for Disease Control and Prevention's Checklist for Core Elements of Antibiotic Stewardship in Nursing Homes* as a guide to calculate the percentage of core elements in place that 1) standardize diagnostic criteria for urinary tract infections (UTI); 2) improve the appropriate selection, dose, and duration of antibiotic treatment; 3) promote pharmacists' oversight, 4) encourage utilization of standardized assessment and communication tools; and 5) define stewardship related duties for clinical leaders. Each of the five categories were counted as 20%. The numerator was the number of core elements in writing and the denominator was 100%. The initial aim was to have at least two of the project interventions/recommendations adopted by the stakeholders. Considering the staffing limitations due to COVID-19, only one policy was recommended. The *Agency for Health Care Quality and Research's Draft Policy and Procedures for the Antimicrobial Stewardship Program Policy Letter* template was shared with the compliance team. See Appendix M. The Quality Assurance and Performance Improvement team is normally responsible for reviewing new polices, however due to COVID-19 related staffing restraints, there was a freeze on new policy approvals.

Therefore, the recommended policy will undergo the review process on a later date. Appendix N, Table 10 shows the project did not improve antibiotic stewardship policies or practices changes by the end of the intervention period.

Discussion

Implications for Practice

Adoption of an antibiotic stewardship program has the potential to increase the number of evidence-based and cost-effective solutions endorsed by LTCFs. They allow LTCFs to compete in a highly competitive market where consumers have an increasing number of care options. The free, online toolkits and templates developed by the AHRQ, AMDA and CDC offer readily available interventions that can be implemented amidst competing priorities and high staff turnover. Stewardship helps to standardize care and judicious use of antibiotics for LTCFs that have multiple locations, including home hospice. Implementing 1-2 interventions at a time like the *Suspected UTI SBAR form* allows LTCFs to accurately measure the degree to which each intervention impacts healthcare outcomes. Converting the *Suspected UTI SBAR form* to an electronic version using tools like Microsoft Forms and SharePoint, allow for seamless introduction into the current workflow, easy access to data for communication and analytics, and improvement in the organizations' carbon footprint.

As aforementioned, distinguishing between ASB and UTI can be challenging. Stewardship endorses confidence amongst clinicians aiming to select the appropriate diagnosis, drug, dose, and duration of treatment for one of our most vulnerable populations. It endorses confidence amongst providers who rely on the assessment and communication skills of on-site nursing staff. Lastly, it endorses confidence amongst residents and caregivers seeking trusted clinicians who can explain things in a way that makes sense to them. Interventions like the

Suspected UTI SBAR form can be utilized to enhance communication, improve education, and promote shared decision making with residents and caregivers. Resident and caregiver requests for antibiotics, which is often seen as harmless, has been a reported barrier to quality improvement. The *Suspected UTI SBAR form* in conjunction with other stewardship efforts is one way to help overcome this barrier.

Implications for Healthcare Policy

The implementation of an antibiotic stewardship policy for the treatment of asymptomatic bacteriuria in older adults is arguably one of the only ways to sustainably standardize judicious use of antibiotics. Given high staff turnover, leadership changes, and an unpredictable post-pandemic future, policy offers a consistent approach to ensuring practices and protocols are evidence-based. While developing policy can be time consuming and seen as low priority, the AHRQ has provided a free, readily available, and easy to understand template for LTCFs to customize. As mentioned, there is a paucity of data on economic models of infection prevention, specific strategies to overcome the unique challenges in LTC, and the methodologies used to integrate palliative care and infection management. LTCFs that discover solutions to fill these gaps in knowledge stand to lead the way by developing their own policy blueprint that can be disseminated globally. Because most stewardship practices have been adopted from acute care, LTCFs stand to benefit from the guidance of other LTC organizations on how to implement and optimize decision-making tools for different LTC settings.

Implications for Executive Leadership

Establishing an antibiotic stewardship committee is essential to ensuring stewardship goals are met. The latest evidence, AMDA, and CMS emphasize the importance of having

leadership, including the medical director, an Infection Preventionist, and prescribing providers involved in the antibiotic stewardship committee and/or stewardship efforts (including policy development, implementation, and sustainability). When implementing a tool like the *Suspected UTI SBAR form*, it is important to have the end user (nurses) involved in the decision-making process when determining whether the form should be electronic or paper, the best place to store it (for example, SharePoint), and modifications to make (like adding documentation for resident and caregiver education to evaluate progress). Identifying a nurse champion who provides direct patient care for the target population helps gain buy-in and obtain feedback from the nursing staff. Ultimately, the decision of whether to prescribe antibiotics will be left to the provider. While it may be challenging for providers to find time to participate in quality improvement projects, stewardship toolkits and templates like the one-page version of the *Suspected UTI SBAR form* are designed with commonly used medical terms that can be quickly explained and understood for rapid adoption and modification. Using software like Microsoft that clinicians are very familiar with, also helps to speed up adoption. Stewardship requires interdisciplinary efforts from medicine, nursing, pharmacy, and the IT and finance departments. Nurse executives are ideally positioned to unite these disciplines and promote sustained engagement.

Implications for Quality/Safety

Standardizing clinical assessment documentation, communication, and antibiotic usage for asymptomatic bacteriuria for hospice patients throughout the organization will comply with CMSs mandate for LTCFs to adopt an antibiotic stewardship program. Adopting a stewardship program will help the organization reduce the threat of antibiotic resistance in the community, reduce hospital admissions, and improve the quality of care for residents, especially at the end-of-life. More emphasis needs to be placed on the fact that antibiotics are a high-risk medication

and there is an increased prevalence of antimicrobial resistance among older adults due to inappropriate antimicrobial prescribing. Clinicians need to be encouraged that even the smallest effort, like using a decision-making tool, can significantly reduce *C. diff* infections, health care expenses, and negative side effects on metabolism, digestion, and immunity which impact the acuity of care they provide and quality of life for the residents.

Plans for Sustainability and Future Scholarship

Antibiotic stewardship is an ongoing effort that requires continuous monitoring. CMS requires LTCFs to adopt policies and procedures to identify and monitor antibiotic usage as part of their infection prevention and control program. The establishment of an antibiotic stewardship committee will significantly support sustainability efforts. The antibiotic stewardship policy for asymptomatic bacteriuria in older adults should identify which clinical roles (nurses, providers, pharmacists, and IT department) should be represented in the antibiotic stewardship committee. To further support the committee and sustainability, job descriptions should clearly state each clinician's role when it comes to stewardship, including the participation in the committee. Future scholarship should evaluate the impact of an antibiotic stewardship committee when it comes to the appropriate usage of antibiotics for older adults at the end-of-life.

Surveillance efforts should include the monitoring, reporting, and quality improvement of costs. As mentioned, several antimicrobial stewardship programs in LTCFs have been adapted from the acute care setting. Future scholarship should assess and evaluate different economic models of infection prevention to determine specific strategies to overcome the limited resources (including staff) in LTC settings. The latest evidence reveals one of the more successful stewardship strategies to support sustainability included sharing and comparting antibiotic

prescription patterns with providers as a source of education and awareness, not penalty. Future scholarship should evaluate whether sharing prescription patterns with providers impacts costs.

As mentioned, there is a paucity of data when it comes to the integration of palliative care and infection management in LTC settings. There is also a lack of knowledge when it comes to understanding the difference between palliative care and infection management. This QI project revealed there are varying beliefs and prescription practices when it comes to the empiric treatment of UTIs. Future scholarship should evaluate stewardship interventions that integrate palliative care and infection management for EOL residents, namely the utilization of antibiograms. Future studies should also look at the impact of educating clinicians about the differences between palliative care and infection management, and how the two intersect in LTC settings. Education should be interactive and occur at the time of hire and included with continuing education annually. The latest evidence suggests education alone (including handouts and pocket guides) will not improve judicious use of antibiotics. Therefore, educational interventions should always be multifaceted and coupled with additional quality improvement efforts.

Conclusion

Antibiotic stewardship is a necessary component to ensure judicious usage of antibiotics for older adults residing in long-term care at the end-of-life. This QI project was implemented to standardize clinical assessment documentation and improve the appropriate prescribing of antibiotics for asymptomatic bacteriuria, antibiotic stewardship policies and practice changes, clinician attitude and beliefs about antibiotic usage, and the education of clinicians on the criteria for appropriate antibiotic treatment of urinary tract infections. While challenges related to the

COVID-19 pandemic prevented the objectives from being met, there is great support for antibiotic stewardship efforts at the hospice organization. Nurses, providers, the IT department, pharmacy, and stakeholders understand the importance of stewardship and are eager to support quality improvement efforts. Future scholarship at this practice site will only help to improve the quality of life of residents and caregivers with end-of-life of life care.

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Appendices

Appendix A. SWOT Analysis

	Helpful To achieving the objective	Harmful To achieving the objective
Internal Origin {Attributes of the organization}	Strengths Utilization of an interdisciplinary, team-based model of care Ability to deliver urgent, primary, palliative and hospice care Strong telehealth and community-based infrastructure in place prior to pandemic A Direct Contracting Entity for The Center for Medicare and Medicaid Innovation, participates in value-based care arrangements	Weaknesses Outpatient setting with extended wait time for diagnostic labs, exams, and processing times; providers are heavily dependent on nursing staff and caregivers to make diagnosis Infection control issues in congregate settings Insufficient staff to meet the needs of patients with higher acuity illness and comorbidities Patients with cognitive and physical impairments, sensory deficits, and language barriers having difficulty with accessing telehealth
External Origin {Attributes of the organization}	Opportunities Popularization and acceptance of telehealth, health-monitoring devices, and at home diagnostics that can be safely delivered within the home Growing need for clinicians trained in geriatrics and gerontology Federal government waiving restrictions for Medicare beneficiaries and in-person visits Home services provide a lower cost of care helping to increase the sustainability of these services and reimbursement rates post-COVID	Threats COVID has negatively impacted social determinants of health like education, employment, housing, and transportation which have affected people's physical and psychological health, and financial stability Competition with other healthcare systems that have decreased staff-to-patient ratios, increased compensation, and provide algorithms and decision-making aids Stigma of palliative and hospice care Interoperability; data privacy and security; and storage of big data

Appendix B. QI EVALUATION PLAN

Aim 1: Increase completeness of clinical assessment documentation (SBAR) prior to contacting resident's prescribing provider

Measure	Measure Type*	Data Source	Sampling Method	Timing/Frequency
Percentage of clinical assessment documentation (SBAR) completed prior to contacting the resident's prescribing provider	Process	Patient chart	All patients enrolled in hospice care during the intervention period	Daily for 1-month pre/post roll out

Standard Measure?**	No https://www.ahrq.gov/sites/default/files/wysiwyg/nhguide/4_TK1_T1-SBAR_UTI_Final.pdf
Numerator	Number of clinical assessment documentation (SBAR) completed prior to contacting the resident's prescribing provider
Denominator or Population***	Number of patients suspected to have a UTI
Exclusions	Non-hospice patients
Calculation/Statistic(s)	Percentage
Goal/Benchmark	100%

Data Elements	Variable Name	Definition	Data Type*	Data Values & Coding	Restrictions/ Validation
Patient Identifier	pat#	System generated unique identifier	Continuous	N/A	
UTI SBAR	UTI_SBAR	Was the clinical assessment documentation (SBAR) completed prior to contacting the resident's prescribing provider?	Dichotomous	1, Yes; 0, No	Required

Aim 2: Decrease the percent of inappropriate antibiotic initiation for patients that do not meet the criteria

Measure 1	Measure Type*	Data Source	Sampling Method	Timing/Frequency
Percentage of inappropriate antibiotic initiation for patients that do not meet the criteria	Outcome	Health record	All patients enrolled in hospice care during the intervention period	Daily for 1-month pre/post roll out
Standard Measure?**	No			
Numerator	Number of patients not meeting criteria in which antibiotic was initiated			
Denominator or Population***	Number of patients not meeting criteria			
Exclusions	Non-hospice patients			
Calculation/Statistic(s)	Percentage			
Goal/Benchmark	Decrease by 100%			

Data Elements	Variable Name	Definition	Data Type*	Data Values & Coding	Restrictions/ Validation
Patient Identifier	pat#	System generated unique identifier	Continuous	N/A	
Antibiotic criteria	Abx_criteria	Did the patient meet the criteria for antibiotic treatment?	Dichotomous	2, Yes; 1, No; 0, Unknown or no answer	Required

Aim 3: Increase the number of prescribing policies and practice changes to promote/support antibiotic stewardship

Measure	Measure Type*	Data Source	Sampling Method	Timing/Frequency
Average number of antibiotic stewardship policies and practice changes	Structure	Policies and Job descriptions	All policies and job descriptions	Pre- and Post-intervention
Standard Measure?**	No			

Numerator	Mean number of antibiotic stewardship policies and practices
Denominator or Population* **	Policies and job descriptions that endorse antibiotic stewardship
Exclusions	Policies or practice changes not related to antibiotic stewardship practices
Calculation/Statistic(s)	Mean
Goal/Benchmark	At least 1 policy or practice change

Data Elements	**Variable Name**	**Definition**	**Data Type***	**Data Values & Coding**	**Restrictions/ Validation**
Urinalysis	UA	Is there a policy in place that requires diagnostic criteria for UTI to be met prior to ordering a urinalysis?	Dichotomous	1, Yes; 0, No	Required
Communication tool	SBAR	Is there a communication tool to guide nursing-provider communication for suspected UTI?	Dichotomous	1, Yes; 0, No	Required
Reduce Antibiotic treatment length	Time_Out	Is there a policy in place to reduce length of inappropriate antibiotic treatment?	Dichotomous	1, Yes; 0, No	Required
Pharmacy	Pharm	Is there a policy in place to guide pharmacists in improving appropriate usage of antibiotics?	Dichotomous	1, Yes; 0, No	Required
Leadership	Leads	Are stewardship-related duties included in the job description for the medical director, director of nursing,	Dichotomous	1, Yes; 0, No	Required

		or consultant pharmacists?			

Aim 4: Improve clinician attitude and beliefs about antibiotic usage

Measure	**Measure Type***	**Data Source**	**Sampling Method**	**Timing/Frequency**
Clinician attitude: average percentage rating on nurse and provider survey	Balance	Attitude and beliefs survey	All hospice clinicians in DC metro region	Post-intervention period

Standard Measure?**	No https://www.health.state.mn.us/diseases/antibioticresistance/hcp/asp/ltc/apxd.pdf
Numerator	Mean rating on clinician survey
Denominator or Population***	Clinicians involved in the assessment, treatment and/or diagnosis of hospice patients
Exclusions	Non-hospice clinicians in DC region
Calculation/Statistic(s)	# of responses/percentage
Goal/Benchmark	100% response rate

Data Elements	**Variable Name**	**Definition**	**Data Type***	**Data Values & Coding**	**Restrictions/ Validation**
Clinical role	Role	Please select your current role	Categorical	1, RN 2, LPN 3, MD/DO 4, NP 5, PA 6, Other	Required
Clinician Experience	Experience	How many years have you been working in a long-term care facility?	Categorical	1, 0-5 2, 6-10 3, 11-20 4, More than 20	Required

Antibiotic use	Abx_use	When selecting a response that most accurately reflects your opinion regarding antibiotic use, please choose from the following options: 'antibiotics rarely contribute,' 'antibiotics sometimes contribute,' or 'antibiotics often contribute.' I believe that using abx contributes to: 3a, Diarrhea 3b, Future resistance 3c, Reduced rates of influenza 3d, High quality care 3e, Interaction with other meds 3f, Rash 3g, Family perception of high-quality care	Categorical	1, Rarely 2, Sometimes 3, Often	Required
Indwelling catheter	Foley	When selecting a response that most accurately reflects your opinion about when antibiotics are appropriate for a resident WITH an indwelling catheter and ONLY the following symptoms/findings, please choose from the following options: 'rarely appropriate,' 'sometimes appropriate,' or 'often appropriate.' 4a, Resident with foul-smelling urine 4b, Resident with bacteria in urine 4c, Resident with bacteria and white blood cells in urine	Categorical	1, Rarely 2, Sometimes 3, Often	Required

		4d, Change in functional status and family concern about a possible infection 4e, New confusion and history of UTI 4f, Positive influenza rapid test 4g, Cough and green or yellow nasal discharge			
No indwelling catheter	No_foley	When selecting a response that most accurately reflects your opinion about when antibiotics are appropriate for a resident WITHOUT an indwelling catheter and ONLY the following symptoms/findings, please choose from the following options: 'rarely appropriate,' 'sometimes appropriate,' or 'often appropriate.' 5a, Resident with foul-smelling urine 5b, Resident with bacteria in urine 5c, Resident with bacteria and WBCs in urine 5d, Change in functional status and family concern about a possible infection 5e, New confusion and history of UTI 5f, Positive influenza rapid test 5g, Cough and green or yellow nasal discharge	Categorical	1, Rarely 2, Sometimes 3, Often	Required
UTI recommendation	UTI_rec	When selecting a response that most accurately reflects your opinion about when action should be taken,	Categorical	1, Rarely 2, Sometimes 3, Often	Required

		please choose from the following options: ‘rarely take the following action,’ ‘sometimes take the following action,’ or ‘often take the following action.’ When assessing an otherwise stable and alert resident with a fever, no other complaints, and a history of urinary tract infections (UTIs), would you: 6a, Increase frequency of monitoring vital signs 6b, Obtain an order for urinalysis and culture 6c, Recommend this resident receive abx 6d, Review resident history and symptoms 6e, Review resident’s current meds 6f, Encourage fluids (if no restriction) 6g, Recommend this resident be evaluated in an Emergency Department/clinic			
Antibiotic beliefs	Abx_beliefs	When selecting a response that most accurately reflects your beliefs about ways to prevent the spread of diseases, please choose from the following options: ‘disagree,’ ‘neutral,’ or ‘agree.’ 7a, I don’t have to change gloves between resident rooms if I am just emptying foley bags 7b, I only need to remove gloves when they look dirty	Categorical	1, Disagree 2, Neutral 3, Agree	Required

		7c, Flu can be spread to others before the infected person has symptoms of influenza 7d, You can get the flu from the flu shot			
UTI criteria	UTI_criteria	Scenario: A resident has cloudy, foul-smelling urine; is agitated; slightly more confused than baseline; and has a history of UTI; T = 99.1°F. What would you do? (Circle all that apply).	Categorical	1, Recommend this resident receive antibiotics 2, Document resident status and continue to monitor 3, Contact the provider for an order to send a urine specimen to the lab for a urinalysis (UA)/urine culture (UC) 4, All the above	Required
Virus treatment	Virus_tx	I believe antibiotics are effective against infections caused by viruses such as influenza.	Dichotomous	1, True 2, False	Required
Antibiotic allergy	Abx_allergy	I believe that other than an allergy to an antibiotic, there are no side effects to taking antibiotics.	Dichotomous	1, True 2, False	Required
Clostridium difficile	Cdiff	When selecting a response that most accurately reflects your beliefs about Clostridium difficile (C. diff) infection, please choose from the following options: 'disagree,' 'neutral,' or 'agree.' 8a, Antibiotics are a major risk factor for developing C. Diff 8b, C. diff testing requires 3 stool samples.	Categorical	1, Disagree 2, Neutral 3, Agree	Required

		8c, A test-of-cure should be done after completion of C. diff treatment 8d, C. diff can be spread by healthcare worker hands. 8e, Test only unformed stool (stool that takes the shape of the container).			
UTI recommendation	UTI_rec	When selecting a response that most accurately reflects your opinion about when action should be taken, please choose from the following options: 'rarely take the following action,' 'sometimes take the following action,' or 'often take the following action.' When assessing an otherwise stable and alert resident with a fever, no other complaints, and a history of urinary tract infections (UTIs), would you: 9a, Increase frequency of monitoring vital signs 9b, Order urinalysis and culture 9c, Initiate empiric antibiotic 9d, Review resident history and symptoms 9e, Review resident's current meds 9f, Encourage fluids (if no restriction) 9g, Refer resident to Emergency Department/clinic for evaluation	Categorical	1, Rarely 2, Sometimes 3, Often	Required
Antibiotic beliefs	Abx_beliefs	When selecting a response that most accurately reflects your	Categorical	1, Disagree 2, Neutral	Required

		beliefs about ways to prevent the spread of diseases, please choose from the following options: 'disagree,' 'neutral,' or 'agree.' 10b, I only need to remove gloves when they look dirty 10c, Flu can be spread to others before the infected person has symptoms of influenza 10d, You can get the flu from the flu shot		3, Agree	
UTI criteria	UTI_criteria	Scenario: A resident has cloudy, foul-smelling urine; is agitated; slightly more confused than baseline; and has a history of UTI; T = 99.1°F. What would you do? (Circle all that apply).	Categorical	1, Initiate empiric antibiotic 2, Order a urinalysis/urine culture 3, Encourage fluids (if not contraindicated) and continue to monitor	Required
Antibiotic stewardship program	ASP	When selecting a response that most accurately reflects your beliefs regarding the usefulness of the antimicrobial stewardship strategies below, please choose from the following options: 'rarely useful,' 'sometimes useful,' or 'often useful.' 11a, Available order sets to guide antibiotic prescribing 11b, Facility process for reviewing empirically prescribed antibiotics based on culture results 11c, Lab summary report of antibiotic resistance	Categorical	1, Rarely 2, Sometimes 3, Often	Required

		among facility residents (antibiogram) 11d, Feedback from a pharmacist on antibiotic prescribing practices to medical personnel 11e, Nursing education to enhance capacity to accurately assess and report resident condition 11f, Education to residents and family about antibiotic use			

Aim 5: Increase clinician knowledge of antibiotic stewardship for urinary tract infections

Measure 1	**Measure Type***	**Data Source**	**Sampling Method**	**Timing/Frequency**
Average rating on knowledge survey	Knowledge	Clinician survey	All hospice clinicians in DC metro region	Pre-test and Post-test preintervention

Standard Measure?**	No
Numerator	Mean rating on knowledge survey
Denominator or Population***	All clinicians involved in the assessment, treatment and/or diagnosis of hospice patients
Exclusions	Non-hospice clinicians
Calculation/Statistic(s)	Percentage
Goal/Benchmark	100%

Data Elements	**Variable Name**	**Definition**	**Data Type***	**Data Values & Coding**	**Restrictions/ Validation**
Clinician Identifier	clinician#	Clinician title	Categorical	1, Physician 2, Nurse practitioner 3, Registered nurse	Required

				4, Licensed practical nurse	
Asymptomatic bacteriuria	ASB	Is the following statement true or false? Asymptomatic bacteriuria is defined as a bacterial count of greater or equal to 10^5 cfu/mL without clinical symptoms of UTI.	Dichotomous	1, True; 0, False	Required
Risk factors	Riskfx	Which is the following are risk factors for the development of ASB in LTC residents?	Categorical	1, Increased age 2, Increased number of diagnoses 3, Decreased ability to perform ADLs 4, Indwelling urinary catheter 5, All of the above	Required
Asymptomatic bacteriuria treatment	ASB_Tx	Randomized trials have described the effect of antibiotic treatment for ASB among LTCF residents. Which of the following effects have not consistently shown in these studies?	Categorical	1, No effect on morbidity and mortality 2, No effect of symptoms of chronic incontinence 3, Increase in the number of acute episodes of UTI	Required

Urinary tract infection symptoms	UTI_sx	A thorough nursing assessment is an essential component of care for a resident with a possible urinary tract infection. Which of the following symptoms or conditions is not important when assessing a resident who may have a UTI?	Categorical	1, Symptoms of dysuria or urinary urgency/frequency 2, New onset or worsening of delirium, rigors, or urinary incontinence 3, Tenderness in the suprapubic and costovertebral angle areas on palpation 4, Hematuria 5, None of the above	Required

Appendix C. Evidence Table

Article #	Author & Date	Evidence Type	Sample, Sample Size, Setting	Study findings that help answer the EBP Question	Observable Measures	Limitations	Evidence Level & Quality
1	Doernberg et al., 2015	Quasi-experimental	Nonrandom Sampled residents started on abx for UTI at 3 LTCFs in Northern California Abx prescriptions *n*= 104 Intervention period: Sept 2011 to May 2012	ASP led to modest decrease in abx utilization	1) ID-trained pharmacist conducted prospective wkly chart review, 2) consulted ID-trained MD, 3) formulated abx recommendations using Loeb criteria, 4) notified primary provider, and 5) pharmacist conducted f/u chart review to evaluate the number of accepted recommendations: 25% (10) out of 38% of abx recommendations were accepted by providers as a result of pharmacist-led audit-feedback (abx use measured as abx starts per 1000 resident-days)	Difficult establishing interpersonal relationship and buy-in with providers due to lack of face-to-face interaction, remote care, and lack of prior provider-to-provider relationship Limited access to prescription data	Level II Good Quality

					Immediate 26% decrease in abx use for UTIs per month during initial phase of intervention was (9% change from pre-intervention) Abx use for UTIs per month decreased by 6% after the initial intervention effect and remained 6% during intervention period (abx rates calculated based on number of cases of each resistant organism normalized to 1000 resident-days) Incidence rate-ratio for abx Rx after intervention was 0.91 (P <0.001)		
2	Hui-Chih et al., 2019	Systematic review with meta-analysis of RCT, controlled pre-post	Studies included overall N = 18	Antimicrobial interventions reduced abx usage regardless of study design	1) Pooled ratio using inverse variance weighting and random-effects models (95% CI) revealed educational	There was no standardization of strategies, evaluation, or reporting	Level II Good quality

		studies, and uncontrolled pre-post studies examining impact of antimicrobial stewardship interventions on overall antimicrobial use	Studies included in meta-analysis N = 11 Set in LTCF and NH in the United States N = 12 One study each in Australia, Canada, Canada and US, Netherlands, Sweden, and UK Articles published between 1990-July 2018	Effectiveness of abx stewardship strategies dependent on LTCF resources There is no specific strategy to recommend due to variability in interventions and multifaceted approaches	materials, educational meetings, guideline implementation, ASP, audit and feedback, reminders, a local opinion leader, patient-mediated interventions, QI, educational outreach, financial incentives, community of practice, and tailored interventions decreased abx usage by 14% (P < .0001) for 2.5 years	Most studies had high risk of bias Limited number of studies on abx usage in LTCFs Limited number of validated quality appraisal tools	
3	Lee et al., 2018	Prospective chart audit, Pre- and Post-analysis	LTCFs in Canada *n* = 7 Patients preintervention n = 62	After staff participated educational intervention residents were five times less likely to receive an abx for ASB Providers ordered fewer	1) Stewardship team conducted pre-intervention audit to assess baseline use of abx and Ucx tests, 2) researcher led 15-min educational intervention, 3) lab conducted prospective chart review to identify	Small sample limits generalizability Short intervention phase Low response rate on survey	Level V Good quality

			Patients postintervention n = 50 Intervention period May – July 2017	inappropriate UCx	positive Ucx and notified stewardship team, and 4) stewardship team conducted postintervention audit to assess abx usage and Ucx tests Pre- v. Post intervention: 172 v. 151 Ucx tests ordered 71 v. 56 Ucx tests were positive and audited 62 v. 50 Ucx tests met inclusion criteria 50 v. 35 of Ucx tests classified as ASB 45 out of 50 (90%) v. 22 out of 35 (63%) of residents with ASB	Few physicians, residents, and families participated in education sessions Too many interventions introduced at once, hindered ability to measure efficacy and effectiveness of each There was no pre- or post-education evaluation of knowledge or satisfaction	

					inappropriately treated with abx (p = 0.003) 15% (212 out of 1454) of multidisciplinary staff participated in educational session Number of Ucx orders decreased from 13.2 to 11.6 per 100 beds (12% decrease, not statistically significant)		
4	McMaughan et al., 2016	Quasi-experimental nonequivalent control group design, Pre- and Post-analysis	Nursing homes in TX *(n = 12)* divided nonrandomly into high intensity intervention (N =4), low intensity (N =4), and control (N =4) Residents	Introduction of decision-making aids significantly reduced unnecessary abx for ASB Presence of incontinence and impaired communication increased likelihood provider	1) High intensity NH, received x2 training for decision making aid and active technical support (asked if assistance was needed) 2) Low intensity NH, received x1 training for decision making aid and passive tech support	Did not survey staff on likelihood to use or barriers to using decision making aid Data abstracted from chart reviews, risk of bias Quasi-experimental nonequivalent control group	Level II Good quality

			n = 547 Intervention period: March 2011 – Feb 2012	prescribed abx for ASB	(offered assistance only if requested) 3) Monthly retrospective chart reviews during 6-month pre- and 6-month post intervention Pre (355) v Post (314) intervention: Number of Rx written for ASB at Control NH increased 69% v. 72%, at Low NH decreased 78% v. 65%, at High NH decreased 65% v. 57%, and in total decreased 71% v. 64% (decreased overall by 10%)	design did not control for all threats to internal validity Sample did not include residents with ASB not treated with abx or residents with sx UTI not treated with abx, this made it difficult to determine the % of residents with ASB who received abx Study did not include residents with ASB not treated with abx which made it difficult to distinguish between improved documentation and improved prescribing practices	

					Prescriptions for ASB at NHs with low fidelity decreased 70 v. 69 (used decision making aid for less than 25% of suspected UTI cases) Prescriptions for ASB at NHs with high fidelity decreased 73 v. 49 (used decision making aid for every suspected UTI case)		
5	Morioka et al., 2020	Cross-sectional survey	Physicians N = 2020 N = 895 In Japan Home care MDs N = 220, n = 123 (nonrandom) Infectious disease MDs N = 600, n = 285 (random)	Providers' backgrounds, beliefs, and perceptions may influence management of infectious disease at end-of-life MDs attitude toward end-of-life patients is diverse and equivocal	1) Nationwide, cross-sectional self-report questionnaire on MD attitude toward infectious diseases for EOL cancer pts mailed to oncology (cancer hospitals), ID, palliative care, and home care physicians (response rate 44%) 2) Respondents answered 10 brief	Did not survey multidisciplinary clinicians	Level III Good quality

			Oncologist MDs N = 600, n =170 (random) Palliative care MDs N = 600, n = 315 (random) 51% worked in cancer center or university hospital, 49% worked in general hospital Intervention period: Nov 2017 to Jan 2018		statements by rating degree of agreement on six-point Likert-type scale from 1 (strongly disagree) to 6 (strongly agree) Reasonable to collect Ucx at EOL = avg. 3.7 Reasonable to refrain from broad spectrum abx as appropriate at EOL = avg. 4 Examination and treatment of infx at EOL beneficial = avg. 4 Minimizing risks of patients considering burden and safety during infectious disease management with only a few weeks prognosis = avg. 5		

					Patients' tx plans should be determined based on MD's own experience instead of medical evidence = avg. 3		
6	Morrill et al., 2016	Systematic review of RCT, quasi-experimental, pre/post survey, observational studies, systematic review, society guidelines	67 articles on interventions in LTCFs from United States, Canada, Finland, London Articles published between 1966 and June 2015	ASP increased the number of infections handled as wait and see by MD Small-group education, videos, written materials, outreach, and interviews improved Rx for suspected UTIs Education of both providers and nurses yielded more positive outcomes than provider-only	1) ASP included diagnostic and tx algorithm for UTIs combined with small group education sessions for nurses, videotapes, written materials, outreach, and MD interviews at NH: Rx for suspected UTIs decreased from 1.59 to 1.17 courses per 1000 RD (not sustained >12 months post intervention) Ucx ordered decreased from 2.48	Lack of pharmacists and physicians with ID expertise Lack of standardization of ASPs Multiple components implemented at once, so efficacy and effectiveness of individual interventions could not be measured	Level IV Good quality

				Use of antimicrobial stewardship tools decreased abx usage Diagnostic and tx algorithm for UTIs combined with small group education sessions for nurses, videotapes, written materials, outreach, and MD interviews did not have significant difference on mortality or hospital adx Antimicrobial stewardship tool combined with educational support pack improved prophylactic abx tx and appropriate	to 2.03 per 1000 RD (nonsignificant) 2) Audit-feedback for nurses and MDs to reduce inappropriate tx of ASB at NH: Rate of treatment for ASB decreased from 1.7 to 0.6 per 1000 RD (P = .002) Inappropriate submission of Ucx decreased from 2.6 to 0.9 per 1000 RD (P < .001) Results sustained for 30 months 3) Multidisciplinary team at LTCF provided updated policy for the dx and tx of UTIs for older adults to providers and head nurses, published		

				prescribing per McGeer and Loeb Criteria	regional guidelines, and then mailed annual questionnaire to head nurse of each unit: Proportion of abx prophylaxis for UTI decreased from 14.5% to 7.8% (P <.001) 4) Audit-feedback to clinicians at hosp and LTCF: Overtreatment of ASB reduced 20% control v. 40% intervention group during study; 10% control v. 19.2% intervention group during maintenance period 5) 2-part antimicrobial stewardship tool used by nurses at		

					LTCF at initiation and 48-72 hrs after starting abx; implemented educational support pack specific for infx in older adults, dedicated telephone support, f/u visits, posters, and promotional materials: Total abx consumption increased by 5% in control v. decreased by 5% per 1000 RD in intervention group (P =.04 v. P = .02) 6) On-site weekly rounds and remote availability by ID physician and NP in Veterans hospital: Total abx use decreased by 30% (P<.001)		

7	Nace et al., 2020	RCT	Convenience, stratified sampling 22 NHs randomized into intervention and control groups Intervention period May 2017 to April 2018	Low-intensity, multifaceted educational intervention reduced treatment of ASB and overall use of abx for UTIs	1) 1-hr education webinar presented by MD, pharmacists and infx preventionist for nurses, pharmacists and prescribing providers 2) Dissemination of posters and pocket cards with dx and tx guidelines for suspected, uncomplicated cystitis 3) Standardized MD order set forms for dx and tx of suspected, uncomplicated cystitis 4) Active monitoring sheet to improve identification and documentation of s/sx associated with dx UTI	LTCFs in intervention group had higher rate of turnover Participants not blinded, risk of performance bias No access to medical records, data obtain from self-report More nursing staff than providers participated	Level I Good quality

					5) 1- page educational clinical vignettes for prescribers and nursing staff targeting common issues of dx and tx UTIs 6) Routine facility-level audit and feedback on UTI rates, compliance with guidelines, and associated outcomes using summative data 7) Web-based coaching sessions x6 weeks for multidisciplinary staff at NH intervention group 8) Single 1-on-1 coaching phone call with infection control nurse or DON to review facility feedback, assess use of stewardship tools, and answer		

					questions during last quarter of intervention period: Antimicrobial use for unlikely cystitis was 27% less in intervention group (P =.004) Rate of Cdiff remained stable in intervention group, increased in control group (P<.001) Overall abx use for any type of UTI was 17% lower in intervention group (P=.04) Number of Ucx 1.52 in control v. 1.39 per 1000 RD in intervention group Incidence of Ucx performed, all-cause hospitalizations, and all-cause death were		

					nonsignificant in intervention compared to control group Descriptive statistics used to summarize categorical (frequencies and percentages) variables stratified by group, facility and/or month using SAS		
8	Ramly et al., 2020	Prospective qualitative descriptive study	68 nursing home clinicians including providers (n = 19), nursing staff (n = 25), and leadership (n =24) 6 Nursing homes in Wisconsin (n =3) and Pennsylvania (n=3)	Antibiotic stewardship strategies must address workflow barriers: nurse and provider education, structured information tools, and organizational improvement	Thematic analysis revealed 3 barriers to abx stewardship: A) information, B) communication, C) professional barriers A: Inconsistent nurse assessment reporting, misalignment between work and tools of information sharing B: Mismatched perception of	Dependent on self-reported data, risk of bias	Level III Good quality

			Dates of intervention period not reported		provider needs, difficulties reaching providers C: Low provider confidence in nurse assessment/report, nurse reluctance to express professional opinion		
9	Scales et al., 2017	Cross-sectional survey	31 NHs in North Carolina Nonrandom Providers (MD or OD, NP, PA) n = 50 Nursing staff (DON, assistant DON, nurses, infection control nurse) n = 182	Providers have positive attitude regarding ASP, but concerned with medical and legal risks associated with withholding abx, and compliance of nursing staff to adopt alternative infection management Palliative and hospice trained providers best suited to lead stewardship efforts in LTCFs	Nurses were mailed and providers were emailed or mailed a questionnaire to assess attitude toward reducing abx usage, role of residents and families in prescribing decisions; participants' readiness to adopt new infx management and prescribing practices; and perceived barriers to change: Positive attitude toward reducing abx	Sampling based on convenience and seniority Participants surveyed before intervention period Did not address all components of abx stewardship	Level III High quality

			Dates of intervention period not reported		usage, Nurses 5.4 v. Providers 6.1 on 7-point scale from 1 (strongly disagree) to 7 (strongly agree) (P = .005) Felt residents and families wanted abx tx and influenced decision making, Nurses 2.7 and 2.4 v. Providers 2.6 and 2.2 (scored 1-4: never, sometime, usually, always) Felt families wanted abx more than residents Nurses 3.4 v. Providers 3.1 (scored 1-4: never, sometime, usually, always) (P =.04) Felt families influenced		

					prescribing decisions, Nurses 2.8 v. Providers 2.4 (scored 1-4: never, sometime, usually, always) (P = .02) Readiness to implementing abx stewardship, commitment to change and change efficacy, Nurses 4.1 and 4.0 v. Providers 3.9 and 3.6 on 5-point scale from 1 (strongly disagree) to 5 (strongly agree) Overall readiness of nursing team, Nurses 3.6 v. Providers 2.9 on 5-point scale from 1 (strongly disagree) to 5 (strongly agree) (P <.001)		

					Overall readiness of medical team, Nurses 3.8 v. Providers 3.8 on 5-point scale from 1 (strongly disagree) to 5 (strongly agree)		
10	Tark et al., 2020	Cross-sectional survey	Stratified random sample of Nursing Homes in the United States NHs n = 892 Intervention period Nov 2017 to Oct 2018	Providers less likely to discuss infection treatment preferences during admission or advanced care planning, and more likely after adverse event Residents suspected of having a UTI were less likely to be treated without abx and treated with comfort measures only	1) Web and paper based cross-sectional facility-level surveys sent to DONs with questions on nursing palliative care processes and integration of infx management and palliative care at EOL: On avg, resident and family preferences for infx management at end of life was more likely to be elicited following a change in condition (μ = 85) and less likely during goals of care (μ = 76) or at adx (μ = 73)	Conclusions based on self-reported data from DON with risk of social desirability bias Paucity of data of studies that integrate palliative care and infection management for end-of-life residents limited comparative analysis	Level III Good quality

					Most NH used shared decision making for suspected infx near EOL (μ = 92) and considered residents' goals in managing care (μ = 91) More than half of NH (μ = 53%) gave abx near the EOL For residents suspected of having a UTI at EOL, majority of NH used a straight catheter to collect urine (μ = 67) and started abx (μ = 62) Overall, most NH often gave abx at EOL (μ = 53) In about half of NHs, providers did not use shared decision making (μ		

					= 52) or did not have “do not administer abx” order when managing infx at EOL (μ = 48)		

Abx: antibiotics; Adx: admission; ASB: asymptomatic bacteriuria; ASP: antibiotic stewardship program; f/u: follow-up; h: hour(s); CI: confidence interval; EOL: end-of-life; ID: Infectious diseases; Infx: infection; LTC: long-term care; NH: Nursing homes; RD: resident days; Rx: prescription/prescribing; s/sx: signs/symptoms; tx: treated; UTI: urinary tract infection. This Table of Evidence is adapted from Dearholt, S. & Dang, D. (2018). *Johns Hopkins Nursing Evidence-Based Practice Model and Guidelines*. Indianapolis, IN: Sigma Theta Tau International, Chapters 5,6,7, Appendices D, E, F, and G.

Appendix D. Table 1. Data Collection/Evaluation and Analysis Methods Table

Aims/Evaluation Questions	Measures	Measure Type	Data Source	Recruitment Method/ Population	Timing/Frequency	Calculation/ Statistics	Goal/ Benchmark
Improve the completeness of clinical assessment documentation *Does the use of a decision-making tool improve completeness of the nurse's assessment documentation?*	Percentage of clinical assessment documentation (SBAR) completed prior to contacting the resident's prescribing provider	Process	Suspected UTI SBAR forms via Microsoft Forms	All nurses caring for hospice patients in a long-term care setting during the reporting period	Daily for 1 month during the implementation phase	Percentage	100%
Improve appropriate prescribing of antibiotics for asymptomatic bacteriuria *Does the use of a decision-making tool improve the appropriate prescribing of antibiotics?*	Percentage of inappropriate antibiotic initiation for patients that do not meet the criteria	Outcome	Pharmacy chart review	All hospice patients treated in DC and Maryland (Largo and Montgomery County) during the reporting period	Daily for 3 months pre-rollout and daily for 3 months during the implementation phase	Percentage	Decrease by 100%
Increase the number of antibiotic stewardship policies and practice changes *Does the creation of an antibiotic stewardship committee increase the number of antibiotic stewardship policy and practices changes?*	Project interventions/recommendations being adopted by the stakeholders	Structure	Company policies and written protocols	Headquarters, offices in DC, and Maryland (Largo and Montgomery County)	Calculated twice, pre- and post-implementation phase	Mean	At least 1 policy or practice change
Improve clinician attitude and beliefs about antibiotic usage *Does the use of an electronic decision-making tool improve clinician's*	Average percentage rating on nurse and provider survey	Balance	Antibiotic Use Attitudes and Beliefs Nursing and Provider Survey	All clinicians (MDs, NPs, and nurses) caring for hospice patients in a long-term care setting	Administered once post-implementation phase	Number of responses/percentage	100% response rate

attitude and beliefs about antibiotic stewardship?							
Improve the education of clinicians on the criteria for appropriate antibiotic treatment of urinary tract infections *Does the use of a decision-making tool improve clinician's understanding of the criteria for appropriate prescribing of antibiotics for suspected UTIs?*	Average rating on knowledge survey	Knowledge	Pre-test and-post-test questionnaires	All clinicians (MDs, NPs, and nurses) caring for hospice patients in a long-term care setting	Administered twice, pre- and post-implementation	Percentage	100%

Appendix E. Suspected UTI SBAR FORM

Complete this form before contacting the resident's provider.

Date/Time_____ (DD/MM/Year format will be used as an anonymous patient identifier)

SITUATION

I am contacting you about a suspected UTI for the above resident.

Vital Signs BP____ /_____ HR _____ Resp. rate _____ Temp. _____

BACKGROUND

Active diagnoses

- ☐ No ☐ Yes The resident has an indwelling catheter
- ☐ No ☐ Yes Patient is on dialysis
- ☐ No ☐ Yes The resident is incontinent If yes, new/worsening? ☐ No ☐ Yes
- ☐ No ☐ Yes Advance directives. Specify_____
- ☐ No ☐ Yes Medication Allergies. Specify_____
- ☐ No ☐ Yes The resident is on Warfarin (Coumadin®)

ASSESSMENT

Resident WITH indwelling catheter

The criteria are met to initiate antibiotics if one of the below are selected

No	Yes	
☐	☐	Fever of 100°F (38°C) or repeated temperatures of 99°F (37°C)*
☐	☐	New back or flank pain
☐	☐	Acute pain
☐	☐	Rigors /shaking chills
☐	☐	New dramatic change in mental status
☐	☐	Hypotension (significant change from baseline BP or a systolic BP <90)

Resident WITHOUT indwelling catheter

Criteria are met if one of the three situations are met

No	Yes	
☐	☐	1. Acute dysuria alone
		OR
☐	☐	2. Single temperature of 100°F (38°C) **and** at least one new or worsening of the following:
		☐ urgency ☐ suprapubic pain
		☐ frequency ☐ gross hematuria
		☐ back or flank pain ☐ urinary incontinence
		OR
☐	☐	3. No fever, but two or more of the following symptoms:
		☐ urgency ☐ suprapubic pain
		☐ frequency ☐ gross hematuria
		☐ incontinence

* For residents who regularly run a lower temperature, use a temperature of 2°F (1°C) above the baseline as a definition of a fever.

REQUEST FOR ORDERS

- ☐ Order UA ☐ Urine culture ☐ Record fluid intake
- ☐ Encourage _____ ounces of liquid intake _____ times daily until urine is light yellow.
- ☐ Assess vital signs for _____ days, including temp, every _____ hours for _____ hours.
- ☐ Initiate the following antibiotic

Antibiotic: _____ Dose: _____ Route: _____ Duration: _____

Pharmacist to adjust for renal function (Circle one): Yes / No

- ☐ Other _____

Antibiotic stewardship education provided to (Circle one or more): Resident / Caregiver / Not applicable

Appendix F. Table 3. Percentage of Inappropriate Antibiotics Prescribed

Antibiotic	Baseline Antibiotics for Suspected Urinary Tract Infections Prescribed July 2021 to Sept 2021Indication documented (2, Yes; 1, No; 0, Missing data)
Bactrim	0
Ciprofloxacin	0
Nitrofurantoin	0
Amoxicillin	0
Levofloxacin	0

Appendix G. Table 4. Pre-Knowledge and Post-Knowledge Survey Results Including Missing Data

Intervention	Record ID	Survey Score (%)
Pre	1	50
Pre	2	50
Pre	3	0
Pre	4	100
Pre	5	75
Pre	6	50
Pre	7	75
Pre	8	75
Pre	9	75
Pre	10	0
Pre	11	50
Pre	12	75
Pre	13	75
Post	1	0
Post	2	0
Post	3	0
Post	4	75
Post	5	0
Post	6	50
Post	7	75
Post	8	50
Post	9	0
Post	10	0
Post	11	75
Post	12	0
Post	13	75

Appendix H Table 5. Paired Samples Tests: Pre-Knowledge and Post-Knowledge Survey Results Including Missing Data

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	57.69	13	29.553	8.197
	Posttest	30.77	13	35.581	9.868

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pretest - Posttest	26.923	34.553	9.583	6.043	47.803	2.809	12	.016

Appendix I. Table 6. Pre-Knowledge and Post-Knowledge Survey Results Without Missing Data

Intervention	Record ID	Survey Score (%)
Pre	1	50
Pre	2	50
Pre	4	100
Pre	5	75
Pre	6	50
Pre	7	75
Pre	8	75
Pre	9	75
Pre	11	50
Pre	12	75
Pre	13	75
Post	4	75
Post	6	50
Post	7	75
Post	8	50
Post	11	75
Post	13	75

Appendix J. Table 7. Paired Samples Test: Pre-Knowledge and Post-Knowledge Survey Results Without Missing Data

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	70.83	6	18.819	7.683
	Posttest	66.67	6	12.910	5.270

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pretest - Posttest	4.167	18.819	7.683	-15.583	23.916	.542	5	.611

Appendix K. Table 8. Percent of Suspected UTI SBAR Forms Completed

Record ID	Date	2, Yes; 1, No; 0, Missing data
1	10/26/2021	2
2	10/29/2021	2

Appendix L. Table 9. Antibiotic Use Attitudes and Beliefs Nursing and Provider Survey

Date	Completed: 2, Yes; 1, No; 0, Missing data
10/26/21	0
1/22/22	0

Appendix M. AHRQ's Draft Policy and Procedures for the Antimicrobial Stewardship Program Sample Policy Letter

TO: [Relevant staff]

FROM: [Antimicrobial stewardship program team]

RE: [Name of antimicrobial stewardship program intervention]

DATE: [Date]

Antibiotics are among the most commonly prescribed pharmaceuticals in long-term care settings, yet reports indicate that a high proportion of antibiotic prescriptions are unnecessary. The adverse consequences of unnecessary antibiotic use include adverse drug reactions or interactions, the development of *Clostridium difficile* infections, the emergence of multi-drug resistant organisms, antibiotic failure, increased mortality, and greatly increased costs. The Centers for Disease Control and Prevention characterizes antibiotic resistance as "one of the world's most pressing public health threats." Unnecessary prescribing practices by clinicians and overuse of newer, broad-spectrum antibiotics when either no antibiotic or an older narrow-spectrum drug would suffice are believed to be the primary contributors to this problem. As a result of the above complexities, nursing homes are increasingly recognized as reservoirs of antibiotic-resistant bacteria.

To address these issues, [Name of nursing home] has developed an antimicrobial stewardship program that will [briefly describe goal of selected intervention]. Antimicrobial stewardship is the act of using antibiotics appropriately—that is, using them only when truly needed and using the right antibiotic for each infection. This program includes tools, policies, and procedures that aim to guide nursing home staff toward more responsible and effective use of antibiotics. To achieve our goal, [Name of nursing home] will be [briefly describe specific activities the home will undertake].

This effort, to be implemented beginning [DATE], is crucial to improving outcomes for our residents and the nursing home as a whole. Your participation will be essential.

[NAME AND TITLE OF AUTHORIZING OFFICER] [DATE]

Appendix M. Sample Procedure Letter

TO: [Relevant staff]

FROM: [antimicrobial stewardship program team]

RE: [Name of antimicrobial stewardship program intervention]

DATE: [Date]

Purpose and Scope

This procedure covers the use of [name of form or tool] at [nursing home name]. Antibiotics are among the most commonly prescribed drugs in long-term care settings, yet reports indicate that a high proportion of antibiotic prescriptions are unnecessary. The use of this procedure can help reduce unnecessary prescribing and lead to fewer antibiotic failures and/or adverse events. The procedures that will be put into place are described below. Questions can be directed to the antimicrobial stewardship program team at [provide contact information].

Responsibility for Implementing the Procedure

[Identify who will implement the procedure]

Procedures

[Add details specific to nursing home]

Documentation

[List and attach any documents that will be used, including clinical guidelines, tools, training materials, and monitoring/tracking documents.]

Records

[List any records that will be kept in conjunction with the program (for example, the infection control log).]

[NAME AND TITLE OF AUTHORIZING OFFICER] [DATE]

Appendix M. Sample Policy for Medical Record Referral Form

Nurses completely fill out the Medical Record Referral Form. Use in all situations when a resident has a new problem and infection may be suspected, and is being referred to a medical care provider, including transfer to an emergency department or hospital.

Procedure

Patients suspected of having an infection are assessed and referred to a prescribing clinician or, as necessary to the emergency department or hospital. The form should be used to collect and convey information.

The form is used on an as needed basis any time an infection is suspected, regardless of type of infection.

The purpose of this policy is optimize antibiotic use in nursing homes and reduce unnecessary use of laboratory tests and antibiotics.

The form should be provided to the prescribing clinician and/or emergency department or hospital as appropriate.

Appendix N. Table 10. Percentage of Project Interventions/recommendations Being Adopted by Stakeholders

Standardize diagnostic criteria for urinary tract infections	0
Improves the appropriate selection, dose, and duration of antibiotic treatment	0
Promotes pharmacists' oversight	0
Encourages utilization of standardized assessment and communication tools	0
Defines stewardship related duties for clinical leaders	0
Total percent of recommendations adopted	**0**