Asymptomatic Bacteriuria:

Identification and Management in Long-Term Care

by

Yan Liu

Under Supervision of

Brenda Windemuth

Second Reader

Kathleen Michael

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Abstract

Title: Asymptomatic Bacteriuria: Identification and Management in Long-Term Care

Background: Antibiotics are the most commonly prescribed medication in long-term care (LTC) facilities, and as much as 30% of antibiotic prescriptions are unnecessary. Antibiotic treatment for asymptomatic bacteriuria (AB) is one of the key contributors to antibiotic overuse and the increase in multidrug-resistant organisms in LTC. The guidelines from the Infectious Diseases Society of America suggest that antibiotic treatment of AB can only bring harm to the patient. However, inappropriate antibiotic treatment for AB in LTC remains common.

Local Problem: A retrospective chart review on a 40-bed unit in a city-based LTC facility found that 50% of the patients with no definitive diagnosis of urinary tract infection (UTI) were placed on antibiotics without documented reason. Due to apparent overprescribing of antibiotics, a change in practice for proper identification and management of AB was warranted.

Objective/Aim: The objectives of this quality improvement project were: 1) to develop and implement an evidence-based clinical pathway (CP) to assist nursing staff to accurately identify and more effectively manage AB, and 2) to educate and mentor nursing staff and leadership to successfully implement the clinical pathway and evaluate the practice changes. The anticipated outcomes of the project were 75% compliance with using clinical pathway and a 15% decrease in the number of patients treated with antibiotics for UTI.

Intervention: The pre-post design was used. The setting was a 40-bed unit in an urban LTC facility. The sample consisted of the residents (40) in the unit. The project took place over a 14-week period. Education was provided to the staff with six in-services, ongoing instruction, and poster presentation. Baseline data were collected, and weekly chart audits and run charts were conducted. The outcome measures were collected and the comparison with the baseline was made.

Results: The risk ratio revealed that patients without specific UTI symptoms in the baseline group had 9 times the risk of being diagnosed with UTI compared to the follow-up group, and there was a statistically significant difference as well as clinical difference between these two groups: RR = 9, 95% CI [68, 1.2], $p = 0$. Compared with the baseline group, the use of antibiotics for UTI in the follow-up group decreased 38.9%, and overall antibiotic usage decreased 25%. In the last month of the data collection phase, nursing staff compliance with the CP was 100%. Overall, the design and intervention of the project was effective with positive outcomes and there were no adverse events due to usage of the CP during the project.

Conclusion: The CP for identification and management of AB in an LTC facility was effective in reducing the number of the patients treated with antibiotics for UTI, and with good staff compliance. Due to the nature of this quality improvement project, its generalizability for application to other facilities or quality improvement projects is limited. However, the findings of this project add to the evidence for the effectiveness of the McGeer and Loeb criteria, upon which the CP is based. Additionally, the project provides valuable information for other similar quality improvement projects.

Overview

Antibiotic resistance caused by overuse of antibiotics is one of the world's most pressing public health threats (World Health Organization, 2018). Antibiotics are the most common medication prescribed in long term care (LTC) facilities, and as much as 30% of antibiotic prescriptions are unnecessary (Center for Disease Control and Prevention, 2016). Antibiotic treatment for asymptomatic bacteriuria (AB) is one of the key contributors to antibiotic overuse and the increase in multidrug-resistant organisms (Beveridge, Davey, Phillips, & McMurdo, 2011).

Asymptomatic bacteriuria is defined as an isolation of a specified quantitative count of bacteria in an appropriately collected urine specimen from an individual without symptoms or signs of urinary tract infection (Fekete & Hooton, 2018). The prevalence of AB in elderly people in LTC facilities is as high as 50% in women and 40% in men. Many of these patients are inappropriately treated with antibiotics (Beveridge et al., 2011). The guidelines from Infectious Diseases Society of America (Hooton et al., 2009; Nicolle et al., 2006), which are consistent with significant evidence-based literature, suggest that antibiotic treatment of AB can only bring harm to the patient. However, inappropriate antibiotic treatment remains common. In a study by Spivak et al. (2017), the evaluation of over 2000 cases of bacteriuria among veterans demonstrates that nearly 70% of patients with AB are treated with antibiotics.

Distinguishing UTIs from asymptomatic bacteriuria is imperative in the LTC setting. Two major sets of guidelines, the modified McGeer guideline (Stone, 2012), and the modified Loeb guidelines (Loeb, 2001) are widely accepted and successfully used in practice to assist with the diagnosis of UTI and AB in LTC facilities. The Loeb criteria provides an effective set of minimum criteria for starting antibiotics, and the modified McGeer criteria were adopted by the

US Department of Health and Human Services and the Centers for Medicare & Medicaid Services as the standard for diagnosis and treatment in LTC facilities.

The project was implemented within a 40-bed unit in a LTC facility in urban Maryland. A retrospective chart review found that 50% of the patients in the unit were diagnosed with UTI and treated with antibiotics, but had no documented specific UTI symptoms. Due to the apparent overprescribing of antibiotics, a change in practice for proper identification and management of UTI and AB was warranted.

The purpose of this quality improvement project was to develop and implement an evidence-based CP for identification and management of AB (figure 1) in order to reduce the inappropriate treatment of AB. The anticipated outcomes upon completion of the project were 75% compliance of the staff with using clinical pathway and a 15% decrease in the number of patients treated with antibiotics for UTI.

Theoretical framework

Rogers' Diffusion of Innovation Theory (DOIT) was created in 2003 and used as a framework for the introduction, dissemination, and adaptation of innovation into practice (Rogers, 2003). It has since been used regularly in healthcare reform to enlighten researchers and clinicians with valuable information about how knowledge can be translated into practice, while its frameworks provide strategies for the adoption of new quality improvement projects.

One of the important concepts of the DOIT is the innovation-decision process, which includes stages of knowledge, persuasion, decision, implementation, and confirmation. In the knowledge stage, the innovation is acknowledged and information is collected. The persuasion stage occurs when information is disseminated to individuals and they exhibit a certain attitude

toward the innovation. At the decision stage, the individuals make their decisions to adopt or reject the innovation. In the implementation stage, the innovation is put into practice, and in the confirmation phase, evaluation of the outcome takes place (Rogers, 2003). The overall objective of the innovation-decision process is to reduce uncertainty about the advantages and disadvantages of an innovation. When applied to this project, the DOIT was used as a framework to inform the nursing staff about the importance of proper identification of UTI and AB in the LTC facility, to train the nursing staff to use the CP via lectures delivered by the DNP project leader (PL), and to motivate them to enhance their management plans for patients with suspected UTI. Education was the starting point, and learning activities such as group discussions were initiated for the nursing staff regarding the prevalence, risk factors, intervention, and treatment of patients with suspected UTI. The training also helped the nursing staff establish a thorough understanding of the CP. In the persuasion stage, the nursing staff was given information to reinforce their understanding of the important role they had in the proper treatment of AB. According to Rogers, the information provided at this stage should have several attributes in correspondence with the theory, including descriptions of the evidence-based practices' advantages, compatibility, complexity/simplicity, trial-ability, and observability. The main advantage of this project was that it had the potential to reduce the improper use of antibiotics, and thereby improve health outcomes and reduce costs. The goal of the project was also consistent and compatible with the nursing staff's existing values and beliefs.

In the decision stage, the professional leaders at the site reviewed the DNP project and its feasibility outcome data and decided to approve the project. The leaders included physicians, nurse practitioners, nurse leaders, and the nursing staff at the facility. During the implementation stage, the nursing staff used the CP and monitored the relevant clinical cases. Finally, in the

confirmation stage, the baseline and follow-up data were collected and the outcome was evaluated.

Literature review

Accurate identification and proper management of AB in long term care was the focus of the evidence in this literature review. The review began broadly with the evidence supporting that no antibiotic treatment is required for AB in different patient populations including LTC facility residents. Then the evidence was reviewed regarding the differentiation of UTI and AB. The evidence review is summarized in Table 1.

The guideline from the Infectious Diseases Society of America (IDSA) (Hooton et al., 2009) was created by a multidisciplinary panel of experts with high authority worldwide in the management of Catheter-Associated Urinary Tract Infection (CAUTI). The purpose of the guideline is to provide recommendations for the diagnosis, prevention, and treatment of CAUTI in adults (mostly in patients hospitalized or in LTC facilities). These recommendations have been developed after rigorous review of studies including: 1) CAAB should not be routinely screened; 2) Pyuria is not diagnostic of CA-bacteriuria or CAUTI; and 3) The presence or absence of odorous or cloudy urine alone should not be used to differentiate CAAB from CAUTI, or used as an indication for urine culture or antimicrobial therapy. Overall, the guideline was of high-quality with good validity, reliability, clinical applicability, and review of evidence. However, some of the studies used were relatively old.

Another high quality IDSA guideline was from Nicolle, 2006. Its purpose was to focus on the diagnosis and treatment of AB in the adult population >18 years of age (including elderly and residents of LTC facilities). The recommendations were developed based upon a review of

published evidence. The recommendations state that screening for, or treatment of, AB is not recommended in most cases, with a few exceptions. Even though this guideline was developed two decades ago, it has been widely used in practice with success.

Two meta-analysis systematic reviews that were chosen underwent thorough and methodologically robust reviews. Koves' study (2017) was the most current systematic review. Its aim was to synthesize evidence about the benefits and harms of treating AB. Fifty studies involving 7088 patients were included in the review. It concluded that for most people, especially elderly patients, treatment of AB with antibiotics was not beneficial, and might be harmful. Overall, it was a highly-rated systemic review. The systemic review from the Cochrane Database (Trestioreanu, 2015) aimed to assess the safety of antibiotic treatment of AB. There were nine studies of medium to high quality, with 1614 participants in this review. No clinical benefit was found for antibiotic treatment of AB, including in the elderly patient population. The limitation of the Trestioreanu review was that some of the evidence was not current.

Modified McGeer guidelines, and modified Loeb guidelines (Stone, 2012; Loeb, 2001) have gained widespread acceptance among infection control experts to assist clinicians to identify and manage UTI and AB. The Loeb criteria for UTI were specifically designed for the purpose of treatment decision making in the LTC facility and were last updated in 2005. Building on evidence from randomized controlled trials, observational studies, and qualitative studies, the Loeb minimum criteria for the diagnosis of UTI in residents of LTC facilities have been widely used since their original publication in 2001. Algorithms incorporating minimum criteria for ordering a urine culture and initiating antimicrobial treatment for UTI were later developed based on the Loeb criteria. The McGeer criteria guideline was first composed over 2 decades ago on the basis of research and expert consensus, and has more recently been updated by Stone and

colleagues (2012). It has been the most-often-used guideline in practice, especially in LTC facilities. Even though the role of the McGeer and Stone criteria for UTI is for surveillance purposes, the McGeer criteria are perhaps the most widely used consensus criteria to identify UTI.

Overall findings from the literature review were consistent. The consensus was that there is no benefit from screening for, or treatment of, AB in most of the population including LTC elderly. Treating AB results in increased side effects, cost, and antimicrobial resistance. Furthermore, the most reliable indicators for UTI in the LTC resident are urinary tract symptoms, and not just bacteriuria, pyuria, or other non-specific clinical changes. Changes in mental status and other non-specific clinical changes should not prompt the ordering of urinalysis and urine cultures if there are no urinary tract symptoms. In such cases, watchful waiting is advised.

The project leader made a clinical pathway based on the guidelines discussed above. It was used to assist nurses to correctly identify UTI and AB, and to help them work with providers to make sure patients with AB were appropriately managed.

Implementation

Design, setting, & sample

This quality improvement project was to create and implement a clinical pathway for the accurate identification and management of asymptomatic bacteriuria to reduce the improper use of antibiotics. The Setting for this project was a 40-bed unit in an urban LTC facility located on the East coast. The convenience sample consisted of the residents in the unit. The exclusion criteria were that the patient is immunosuppressed, pregnant or pending urinary tract surgery. The final patient sample size was 40.

Procedures and timeline

The project took place over a 14-week period. It was implemented on August 30, 2018, as planned. Before starting the project, the PL met with the administrator of the facility and the nurse practitioner to discuss the project implementation details. Also, the baseline data were collected (Table 2). Then the PL recruited members for the implementation team. The team included the medical director as an opinion champion, the unit manager as the opinion champion, and the PL. Two of the staff members who expressed passion for the topic were selected as champions of the project. Education was provided to the staff through 6 times in-service, which covered all shifts, as well as through ongoing education. The educational material from the Minnesota Department of Health was used for training. Copyright permission was obtained from the author (Appendix B). The education stressed the importance of the correct identification and management of AB, and introduced the new CP to the nursing staff. Case studies were also presented throughout the project to help participants consolidate their knowledge. A poster of the project was placed near the nursing station, and a binder with knowledge resources for the project was placed at the nursing station for reference. Throughout the implementation period, the PL continuously provided education and coaching on the CP to the nursing staff, investigated any barriers to implementation of the project, and adjusted the plan accordingly. When there was deviation from the CP, the PL used the real case as context to provide reinforcement education to the staff. The PL helped to motivate the staff by providing positive feedback on their efforts and describing the beneficial impacts of the project. The PL also collected and audited relevant data from the EMR and paper charts, discussed the data with the staff, interviewed patients, and made adjustments to the project plan and strategies as needed. Weekly reports were provided to the project site coordinator, and monthly progress reports and final findings were presented to the administrator, staff, and providers.

Data collection

Prior to the project implementation, the PL used a retrospective chart review to collect the baseline data consisting of the total number of the patients treated with antibiotics for any reason (ATx), and treated for UTI (UATx), the number of the patients who were diagnosed with UTI (UTI), the number of the patients with UTI symptoms who were diagnosed with UTI (SUTI), and the number of patients who were diagnosed with UTI without specific UTI symptoms (NSUTI).

Throughout the implementation of the project, the PL conducted a weekly audit (Table 2) and a run chart every other week to monitor progress. The audit tool included chart review and nursing staff and patient interviews. Paper and pen method were used to collect the data.

In the final evaluation phase, the outcome measures of ATx, UATx, UTI, SUTI and NSUTI (Table 2) were collected using the same collection tools as mentioned above. Comparison with the baseline was made to determine if the goals of the project were met.

Data analysis

The PL used a run chart to monitor progress and evaluate the project using the bi-weekly data. The data in Table 2 were used for the run chart. An Excel spreadsheet template was used to develop the run chart, and produced visual charts representing the distance between the progress data and final goal.

Descriptive statistics regarding the patient sample distribution (gender, age, race) were also calculated. The data were entered into a spreadsheet and analyzed using the Microsoft Excel statistical package. An unpaired *t*-test was conducted to compare the age difference between the baseline and follow-up groups, and the chi-square test was used to compare the gender and race differences between the two groups.

The relative risk ratio was calculated to compare between the baseline and follow-up group the possibility of patients without UTI symptoms being diagnosed with UTI, and the *p*-values and confidence intervals were also calculated.

Measures to protect human subjects

The project was submitted to the institutional review board (IRB) of the University of Maryland. Since the project is not human research, it was deemed exempt from the IRB process and received clearance from the IRB.

All participants in the project were volunteers. Security and confidentiality were ensured by de-identifying all participant data.

Results

Forty residents living in the 40-bed unit were included in the data analysis. Since the baseline and follow-up population were not identical due to discharges and new admissions in the unit during the project, a statistical comparison was conducted. There was no statistical difference between the baseline and follow-up residents in age, gender and race.

The age range of individuals in the baseline group was from 42 years to 97 years of age, with a mean age of 73.25 years. The age range for the follow-up group was from 55 years to 97 years of age, with a mean age of 72.95. There was no statistically significant difference between the ages of the baseline and follow-up groups: t (80) = .108, p = .91. The predominant gender at the baseline was female (62.5%, n = 25), and male was 37.5% (n = 15). Female and male were equal (50%, n= 20) in the follow-up group, and there was no statistically significant difference in genders between the baseline and follow-up groups: χ^2 (1) =1.27, p = .26. The predominant race was African American. At baseline, African American comprised 77.5% (n = 31), while

Caucasian was 17.5% (n=7), with one participant being of some other race (2.5%, n = 1). In the follow-up group, African American comprised 80% (n = 32), while Caucasian was 17.5% (n = 7) with two participants being of some other race (5%, n = 2). There was no statistically significant difference in race between the baseline and follow-up group: χ^2 (2) = 0.349, p = .84. The relevant risk ratio revealed that patients without specific UTI symptoms in the baseline group had 9 times the risk of being diagnosed with UTI compared to the follow-up group. There was a statistically significant difference as well as clinical difference between these two groups: RR = 9, 95% CI [68, 1.2], p = 0.

Compared with the baseline group, the use of antibiotics for UTI in the follow-up group decreased 38.9%, and overall antibiotics usage decreased 25% (Fig. 2 & Fig. 3). In the last month of the data collection phase, nursing staff compliance with the CP was 100%.

Overall, the design and intervention of the project was effective with positive outcome. During the project, there were no adverse events due to the usage of the CP.

Discussion

This quality improvement project was to introduce a clinical pathway and to provide education to the nursing staff for the correct identification and proper management of AB to decrease the use of antibiotics for treatment of UTI. The outcome of the project was positive, the goals were met, and there were no adverse events due to usage of the CP during the project. An additional unexpected benefit was that, during the project, overall awareness of the staff regarding the overuse of antibiotics increased and their motivation to learn more about antibiotics was apparent. This was not limited to the issue of antibiotic treatment for AB, as overall antibiotics usage decreased 25% in the last month of the project compared to the baseline.

Though more data are necessary to support a cause-effect relationship, it is a compelling observation since decreased use of the antibiotics leads to decreased side-effects, decreased cost, and increased patient safety and satisfaction.

The results of the project are consistent with the findings from numerous publications regarding the proper identification and management of AB. The McGeer criteria and Loeb criteria, upon which the project was based, have been used in many quality improvement projects in LTC with great success.

One of the barriers to successful implementation of the project was that the antibiotic treatment for bacteriuria was prevalent at the facility, making it hard to successfully implement change. Throughout the process, the PL realized that knowledge on the CP needed to be reinforced to have a sustained impact. Even though the initial educational in-services were provided, the staff still required reinforcement of the information where the PL discussed the actual cases with the staff and established a lasting impression. Another challenge was that there was a lack of staff who were available to actively participate throughout the project. Initially, the management of the facility were concerned that the project would interfere with the normal routine of the unit and would add extra work for the staff. The PL took steps to mitigate these concerns, first by making sure that the project was as consistent as possible with the existing policy at the facility. The PL also changed the two longer educational sessions that were originally planned into 6 shorter in-services taking place during the shift changes, to make the timing more convenient for all staff to participate. Thirdly, the PL changed the method of audit and data collection. Instead of having the staff members fill out the forms, the PL actively collected the data using the EMR, patient charts, and interviews with the patients, staff, and providers.

A strength of this project was that the clinical pathway made the complicated process of diagnosis and management of AB easier for the nursing staff to understand and follow. Also, the CP was consistent with the facility policy, which made it more acceptable to the management and staff.

One limitation of the project was that it was designed to focus primarily on the nursing staff. During the project implementation, the PL realized that in order to fulfill the project goal to decrease the improper use of antibiotics for treatment of AB, the provider should also be involved. During dialogues, the nurses reported that they had difficulty communicating with the providers when they observed questionable cases where antibiotics were being prescribed for UTI treatment. In response, the PL adjusted the project plan to include discussions of cases with the providers, and to add educational content for the nurses on how to effectively communicate with the providers.

The small convenience sample, short duration, and its nature as an evidence-based project limited its generalizability. However, the overall observed findings were better than the anticipated outcomes, which demonstrated the effectiveness of the interventions used in the project and confirmed the effectiveness of the two main criteria for identifying and managing AB: the modified McGeer criteria, and modified Loeb criteria.

Conclusion

This quality improvement project implemented an evidence-based clinical pathway for the identification and management of asymptomatic bacteriuria in a long-term care facility. The clinical pathway used in this project proved effective in reducing the number of the patients treated with antibiotics for urinary tract infection, and with good staff compliance with the CP.

Due to the nature of this quality improvement project, its generalizability for application to other facilities or similar quality improvement projects is limited. However, the findings of this project add evidence for the effectiveness of the McGeer and Loeb criteria, upon which the clinical pathway is based, for reduction of the inappropriate usage of antibiotics for urinary tract infection in long-term care facilities. The findings also provide valuable information for other similar quality improvement projects. Upon completion of the project, the PL met with the management team of the facility to discuss the continued use of the clinical pathway in the unit and the possibility of utilizing the CP as part of the UTI policy at the facility. The management team agreed to consider using the CP throughout the facility.

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Tables

Table 1. Evidence Review

Author and Date	**Study objective/intervention or exposures compared**	**Study Design**	**Sample (N)**	**Outcomes studied (how measured)**	**Results**	**Level and Quality Rating**
Köves et al., 2017	To explore if AB treatment is beneficial or harmful	Systematic Review and Meta-analysis	7088	The interventions commonly used to treat or prevent asymptomatic bacteriuria (AB) were considered.	For most people, treatment with antibiotics for AB was not beneficial and may be harmful, including patients in LTC facilities.	IA
Trestioreanu et al., 2015	To find if there is benefit for antibiotic treatment for AB.	Cochrane Database of Systematic Review and Meta-analysis	1614	Patients were assigned to antibiotics or placebo/for treating AB, and results were compared.	No clinical benefit was found for antibiotic treatment of AB, including residents of LTC facilities.	IA
Stone et al., 2012	To develop a guideline for surveillance definition for UTIs in LTC facility.	SHER/CDC position paper	N/A	Systemic review and expert consensus	Surveillance definitions for Urinary Tract Infections (UTIs) in LTC facility.	1A
Hooton et al., 2010	Guidelines for AB management in patients with catheter, especially for hospitalized or LTC residents.	IDSA guideline	N/A	Systemic Review	In the catheterized hospital or LTC facility patient, the presence or absence of odorous or cloudy urine alone should not be used to differentiate CA-AB from CA-UTI or as an indication for urine culture or antimicrobial therapy.	IA
Nicolle et al., 2005	Guideline for AB management in patients without catheter, including LTC elderly.	IDSA Guideline	N/A	Treatment group/no treatment group	Pyuria accompanying AB is not an indication for antimicrobial treatment. Screening for or treatment of AB is not recommended for persons incl. diabetics, elderly,	IA

					with catheter, and LTC elderly.	
Loeb et al., 2001	Develop a guideline for the minimum criteria to start antibiotic treatment in LTC facility.	Expert consensus and literature review.	Modified Delphi approach	Members of SHEA with expertise in the area of infections in residents of LTCFs (including infectious disease physicians, geriatricians, microbiologists, and epidemiologists) were invited to participate in the consensus conference.	Developed minimum criteria to start antibiotic treatment for UTI in LTC facility.	VII B

Table 2. Asymptomatic Bacteriuria Project Data

	3-4 wk.	**5-6 wk.**	**7-8 wk.**	**9-10 wk.**	**11-12 wk.**	**13-14 wk.**	**SUM f/u**	**Baseline**
UTI	2	2	3	1	2	1	11	18
UTI w symptom	2	2	2	1	2	1	10	9
UTI w/o symptom	0	0	1	0	0	0	1	9
Anbx for UTI	2	2	3	1	2	1	11	18
Total antibiotics	4	2	5	2	5	3	21	24

Figures

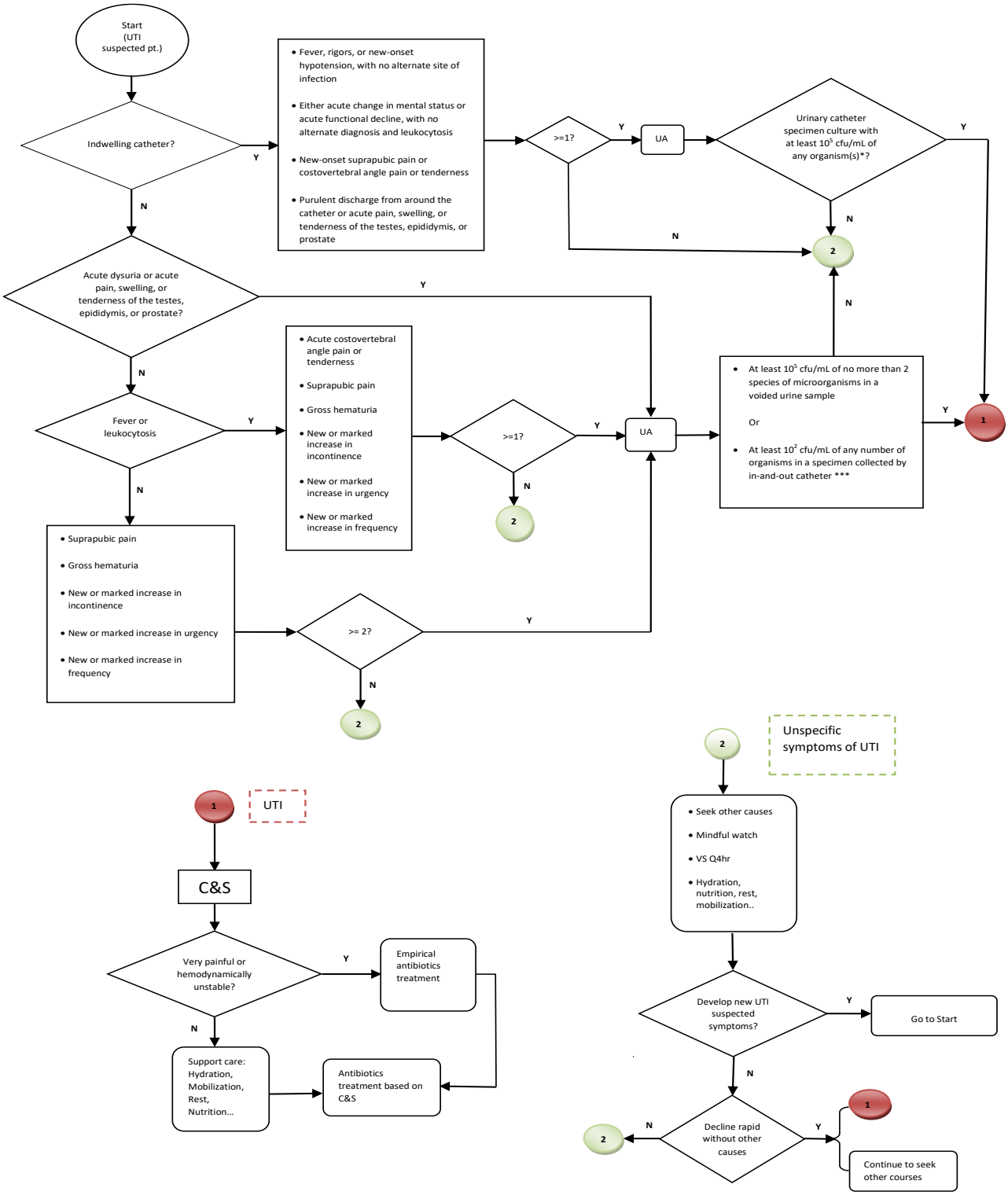

Figure 1. The clinical pathway for diagnosis and management of asymptomatic bacteriuria.

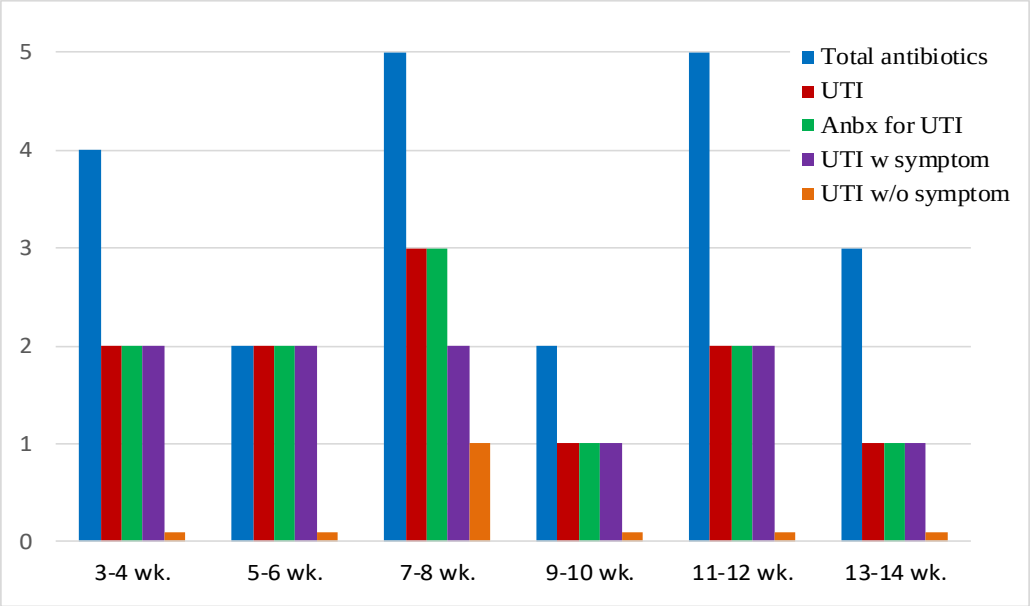

Figure 2. Asymptomatic bacteriuria biweekly data.

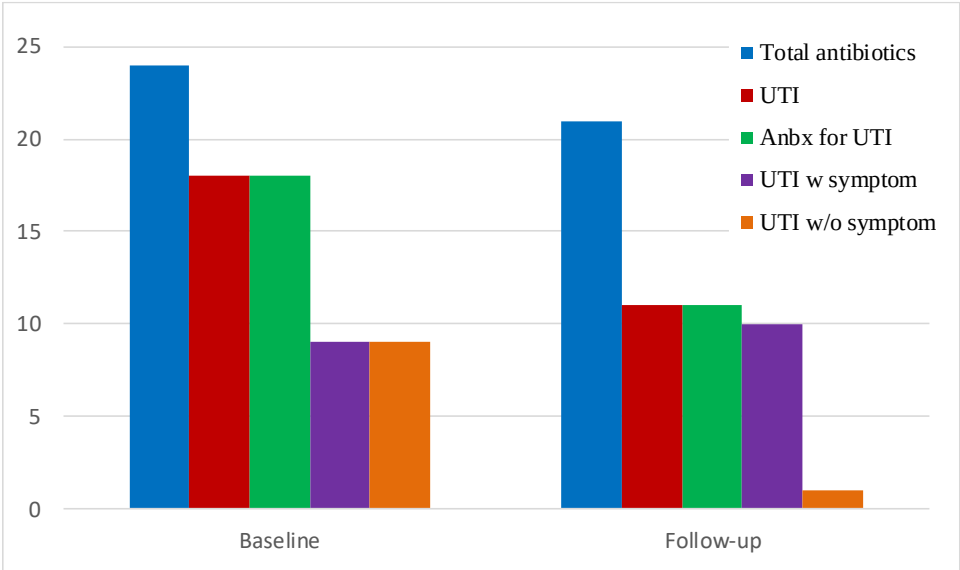

Figure 3. Asymptomatic Bacteriuria comparison of baseline with follow up data.