



Research

Approach of Physicians Working in Primary Healthcare Service to Asymptomatic Bacteriuria and Urinary Tract Infections

Birinci Basamak Sağlık Hizmetlerinde Çalışan Hekimlerin Asemptomatik Bakteriüri ve İdrar Yolu Enfeksiyonlarına Yaklaşımı

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ABSTRACT

Objective: Asymptomatic bacteriuria (ASB) is often misdiagnosed as urinary tract infection. However, it does not require treatment. Although the guidelines recommend against the treatment of ASB with antibiotics, it has been reported that unnecessary antibiotic use is common, especially in outpatient centers. We evaluated the ASB approach in primary care physicians using an internet-based questionnaire.

Methods: In this study conducted between May-August 2021, family physicians working in family health centers in İstanbul and healthcare professionals work as family medicine specialists and residents in training-research hospitals were included. A form that was created to evaluate the descriptive features, urinalysis-urine culture conditions, and the treatments administered was used as a data collection tool.

Results: In this study, 436 family physicians were included. The findings showed that 91.3% (n=398) of the physicians gave treatment to patients who had positive urinalysis or urine culture and had no urinary symptoms. The rate of use of unnecessary treatment by physicians working in family health centers was significantly higher than that in hospitals. We observed that the most frequently used agent in the treatment is fosfomycin.

Conclusion: Most cases of overtreatment of ASB are based on the laboratory results rather than the clinical condition of the patients. The available evidence suggests that a combination of educational and organizational interventions would help improve the distinction between symptomatic urinary infection and ASB and adherence to evidence-based guidelines, and that ASB should be in a priority group for antimicrobial management programs.

Keywords: Asymptomatic bacteriuria, urinary tract infection, primary healthcare service

ÖZ

Amaç: Asemptomatik bakteriüri (ASB) genellikle tedavi gerektirmemesine rağmen idrar yolu enfeksiyonu olarak yanlış teşhis edilir. Kılavuzlar, ASB'nin antibiyotiklerle tedavisi aleyhine tavsiyede bulunmasına rağmen özellikle ayakta tedavi hizmeti verilen merkezlerde gereksiz antibiyotik kullanımının yaygın olduğunu bildirilmektedir. Çalışmamızda birinci basamak hekimlerinde ASB yaklaşımını internet tabanlı anket yoluyla değerlendirmeyi amaçladık.

Gereç ve Yöntem: Mayıs-Ağustos 2021 tarihleri arasında gerçekleştirilen araştırmada İstanbul ilinde aile sağlığı merkezlerinde görevli aile hekimleri ve eğitim-araştırma hastanelerinde aile hekimliği uzmanı ve asistanı olarak görev yapan sağlık çalışanları çalışma kapsamına alındı. Veri toplama aracı olarak; tanımlayıcı özellikler, idrar tahlili-idrar kültürü istenilen durumlar ve verilen tedavilerin değerlendirilmesi amacı ile oluşturulan bir form kullanıldı.

Bulgular: Çalışmaya toplam 436 aile hekimi dahil edilmiştir. Hekimlerin %91,3'ü (n=398) idrar tetkiki veya kültürü pozitif olup üriner semptomu olmayan hastalara tedavi verdiği saptanmıştır. Aile sağlığı merkezlerinde çalışan hekimlerin gereksiz tedavi uygulama oranı hastanelerde çalışanlara göre anlamlı derecede yüksekti. Tedavide en sık kullanılan ajanın fosfomisin olduğu görülmüştür.

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Sonuç: ASB'nin aşırı tedavisi olgularının çoğunun altında, hastanın klinik durumundan ziyade laboratuvar sonuçlarına göre yaklaşımda bulunulması yataktadır. Mevcut kanıtlar, semptomatik üriner enfeksiyon ile ASB arasındaki ayrımın iyileştirilmesinde ve kanıta dayalı kılavuzlara uyulmasında eğitici ve organizasyonel müdahalelerin bir kombinasyonunun faydalı olacağını ve ASB'nin antimikrobiyal yönetim programları için öncelikli grupta olması gerektiğini göstermektedir.

Anahtar Kelimeler: Asemptomatik bakteriüri, idrar yolu enfeksiyonu, birinci basamak sağlık hizmetleri

INTRODUCTION

Asymptomatic bacteriuria, defined as at least 10^5 CFU/mL uropathogen isolated in a sterile urine sample without symptoms of urinary tract infection (UTI), is a common condition in the community (1). Its incidence is estimated at 1%-5% in healthy premenopausal women, 4%-19% in healthy older women and men, 0.7%-27% in patients with diabetes mellitus, 2%-10% in pregnant women, 15%-50% in the older population in healthcare settings, and increases up to 23%-89% in patients with spinal cord injury (1). Asymptomatic bacteriuria (ASB) is often misdiagnosed as UTI, although it does not require treatment (2). Morbidity attributable to bacteriuria is defined only for pregnant women and patients scheduled for invasive urological procedures accompanied by mucosal trauma. Guidelines recommend against treating ASB with antibiotics because randomized trials demonstrated no clinical benefit (1). The harms of unnecessary antimicrobial use have been documented, including antibiotic-associated diarrhea, increased drug resistance to microorganisms, adverse drug reactions, and increased healthcare costs, respectively (3). Despite national guidelines recommending against antibiotic therapy for ASB, high-antibiotic treatment rates continue (4-7). Most of the antibiotics are prescribed within the scope of outpatient services (8,9). The literature shows that unnecessary broad-spectrum antibiotic use is common in outpatient centers (10).

Our study analyzes the approaches of primary care physicians to ASB through an internet-based questionnaire.

METHODS

Due to the lack of a central system and lack of documentation in our country, the diagnosis and treatment of diseases cannot be fully evaluated. Thus, we planned to evaluate the inappropriate treatment of UTI, which is common, by questionnaires of primary care physicians.

In this study conducted between May-August 2020, family physicians working in family health centers in Istanbul and health workers work as family medicine specialists and residents in training-research hospitals were included. According to the data of the medical chambers in Istanbul, there were 4,500 family physicians, and in our study, the

number of cases to be taken to achieve 80% power at the α : 0.05 level was calculated as at least 354. A form that was created to evaluate the descriptive features, urinalysis-urine culture conditions and the treatments administered was used as a data collection tool. To determine the descriptive features, questions were asked to evaluate age, gender, workplace, tenure (year), in which cases urinalysis and urine culture were requested, and if so, what treatment was administered.

Data collection tools were prepared on Google forms and delivered to healthcare professionals online, and responses were collected in the same way. An invitation was sent to all participants using email on May 1, 2020, and the answers given until August 31, 2020, were recorded. All participants were informed before they started to fill out the form, and two options were presented on the informed consent page (yes/no). Only those who chose yes were included in this study. Due to the design of the questionnaire, all questions must be answered to ensure successful participation. In this study, 436 physicians who gave consent to participate in the study were included. It was accepted that no intervention that could disrupt the mucosal integrity of the urinary system would be planned in the primary care setting. The examinations and treatments performed on the asymptomatic patient, except for pregnancy, were evaluated as inappropriate.

Ethics statement: The methodology and questionnaire for this study were approved by the of University of Health Sciences Turkey, Bakırköy Dr. Sadi Konuk Training and Research Hospital Ethics Committee (decision no: 2021-04-15, date: 15.02.2021). The authors assert that all procedures contributing to this work comply with the ethical standards of University of Health Sciences Turkey, Bakırköy Dr. Sadi Konuk Training and Research Hospital and the Helsinki Declaration of 1975, as revised in 2008. The participants' consent to participate in the study was requested personally from each individual.

Statistical Analysis

The NCSS (Number Cruncher Statistical System) program was used for statistical analysis. Descriptive statistical methods (frequency, percentage) were used while evaluating the data. The Pearson chi-square test was used to compare qualitative data, Fisher's Exact test and Fisher-

Freeman-Halton test were used for categorical variables. Statistical significance was set as $p < 0.05$.

RESULTS

This study was conducted with 436 family physicians; 55.5% (n=242) of them were females and 44.5% (n=194) males. 56% (n=244) of the physicians participating in this study were between the ages 25-35, 26.6% (n=116) were between the ages of 35-45, 14.7% (n=64) were between the ages of 45-55 and 2.8% (n=12) were from 55-65 years old.

It was observed that 34.4% (n=150) of the physicians participating in this study worked as resident family physicians, 22% (n=96) contracted family medicine specialists (CFMS), 34.9% (n=152) family physicians and 8.7% (n=38) were specialist family physicians.

It was observed that 59.6% (n=260) of the physicians were assigned to family health centers, 40.4% (n=176) to secondary and tertiary hospitals and 63.8% (n=278) of the physicians had 0-10 years of professional experience, 20.2% (n=88) had 10-20 years, 13.3% (n=58) had a 20-30-year period and 2.8% (n=12) had more than 30 years (Table 1).

They were asked, "in which situations would you like to have a urine test?" and the answers given by the physicians to the question were as follows: 85.3% (n=372) in case of pregnancy, 83% (n=362) when the systemic infection is suspected, 66.9% (n=292) in the presence of a urinary catheter, 29.8%

(n=130) were in advanced age, 38.9% (n=170) from those with chronic disease and 91.7% (n=400) from patients with urinary symptoms.

While 4.1% (n=18) of the physicians stated that they wanted routine urine culture and urinalysis, 95.9% (n=418) stated that they did not. Of the physicians who did not want a routine urine culture with urinalysis, 42.1% (n=176) stated that they wanted a routine urine culture from the patients with urinary symptoms, 32.5% (n=136) from those with chronic disease, 34% (n=142) from those who were pregnant, 70.3% (n=294) from those who had a urinary catheter, 18.2% (n=76) from those with advanced age and 23.4% (n=98) from those with other reasons.

While 46.8% (n=204) of the physicians stated that they wanted a culture from the patient who had urine examination (+) and had no urinary symptoms, 53.2% (n=232) stated that they did not want a culture. 91.3% (n=398) of the physicians stated that they gave treatment to patients who had positive urinalysis or culture (+) and had no urinary symptoms.

The findings showed that 79.9% (n=318) of the physicians used fosfomycin in the treatment, 44.7% (n=178) nitrofurantoin, 21.1% (n=84) quinolone, 13.6% (n=54) sulfonamide, 3.5% (n=14) penicillin, 21.1% (n=84) cephalosporin and 6% (n=24) other agents (Table 2).

There was no statistically significant difference between the distribution of the physicians' treatment-giving status according to age groups ($p > 0.05$).

A statistically significant difference was found between the distribution of the physicians' treatment-giving status by gender. The rate of administering the necessary treatment by female physicians was significantly higher than that of male physicians ($p = 0.001$; $p < 0.01$).

A statistically significant difference was found between the distribution of the treatment status of the physicians according to their duties. The rate of administering the necessary treatment among specialist family physicians was significantly higher than in those with CFMS. Additionally, the rate of administering unnecessary treatment in those with CFMS and family physicians was significantly higher than in those with a family physician resident and family physician specialist ($p = 0.001$; $p < 0.01$).

A statistically significant difference was found between the distribution of the treatment status of the physicians according to their workplace. The rate of administering unnecessary treatment by physicians whose workplace was a family health center was significantly higher than that of physicians whose workplace was a hospital ($p = 0.001$; $p < 0.01$).

Table 1. Distribution of descriptive features

| | | |
|--------------------|----------------------------|-------------|
| Age | 25-35 years | 244 (56.0%) |
| | 35-45 years | 116 (26.6%) |
| | 45-55 years | 64 (14.7%) |
| | 55-65 years | 12 (2.8%) |
| Gender | Female | 242 (55.5%) |
| | Male | 194 (44.5%) |
| Type of physicians | Family medicine resident | 150 (34.4%) |
| | CFMS | 96 (22.0%) |
| | Family physicians | 152 (34.9%) |
| | Family medicine specialist | 38 (8.7%) |
| Work place | Family medicine center | 260 (59.6%) |
| | Hospital | 176 (40.4%) |
| Tenure (years) | 0-10 | 278 (63.8%) |
| | 10-20 | 88 (20.2%) |
| | 20-30 | 58 (13.3%) |
| | >30 | 12 (2.8%) |
| | | |

CFMS: Contracted family medicine specialist

Table 2. Distribution of descriptive features

| | | |
|---|---|-------------|
| Urinalysis requests | Pregnancy | 372 (85.3%) |
| | Suspicion of systemic infection (fever, chills, weakness, etc.) | 362 (83%) |
| | Presence of urinary catheter | 292 (66.9%) |
| | Elderly | 130 (29.8%) |
| | Chronic diseases | 170 (38.9%) |
| | Urinary symptoms | 400 (91.7%) |
| Routine urine culture request with urinalysis | Yes | 18 (4.1%) |
| | No | 418 (95.9%) |
| Urine culture request cases of those who do not have a routine urine culture order with urinalysis | Urinary symptoms | 176 (42.1%) |
| | Chronic disease | 136 (32.5%) |
| | Pregnancy | 142 (34.0%) |
| | Presence of urinary catheter | 294 (70.3%) |
| | Elderly | 76 (18.2%) |
| | Others | 98 (23.4%) |
| Culture request from a patient who has a urinalysis (+) and has no urinary symptoms | Yes | 204 (46.8%) |
| | No | 232 (53.2%) |
| Treatment of patients with (+) urinalysis or culture and no urinary symptoms | No | 38 (8.7%) |
| | Yes | 398 (91.3%) |
| Antibiotics used in treatment | Fosfomycin | 318 (79.9%) |
| | Nitrofurantoin | 178 (44.7%) |
| | Quinolon | 84 (21.1%) |
| | Sulfonamide | 54 (13.6%) |
| | Penicillin | 14 (3.5%) |
| | Cephalosporins | 84 (21.1%) |
| | Others | 24 (6.0%) |

A statistically significant difference was found between the distribution of the treatment status of the physicians according to their tenure. The rate of providing necessary treatment for physicians with 20-30 years of tenure was significantly lower than those of physicians with a tenure of between 0 and 10 and 10-20 years ($p=0.001$; $p<0.01$) (Table 3).

DISCUSSION

The evaluation and improvement of antibiotic administration in outpatient treatment is a major issue. According to the data of the American Centers for Disease Control and Prevention, nearly 80% of antibiotic prescriptions are given in outpatient centers and it is reported that 30% of these prescriptions are unnecessary (11).

UTI is one of the most common infections for which antimicrobials are prescribed, and likewise, most patients prescribed antimicrobial agents do not require treatment (12). This is also true for ASB, which has proven to have a high prevalence, such as women, tuberculosis patients, and older people (13). The overtreatment of ASB may lead to many undesirable consequences, such as the disruption of intestinal flora, which increases the risk of *Clostridium difficile* infection, antibiotic resistance, and increased healthcare-related costs (5,14). Additionally, unnecessary antimicrobial therapy may lead to the development of symptomatic urinary infections by affecting low virulence strains that inhibit the development of uropathogens (15,16).

Guidelines report that diagnosis and treatment of ASB may be beneficial only in two groups of patients: pregnant women and patients scheduled for urological procedures at

Table 3. Comparisons according to treatment situations

| | | Treatment situations | | | p |
|--------------------|---------------------------------------|-------------------------------|---------------------------------|--|----------------------|
| | | Appropriate treatment (n=126) | Inappropriate treatment (n=276) | Treatment required but not prescribed (n=16) | |
| | | n (%) | n (%) | n (%) | |
| Age (years) | 25-35 | 78 (32.5) | 148 (61.7) | 14 (5.8) | ^a 0.076 |
| | 35-45 | 28 (25.9) | 80 (74.1) | 0 (0.0) | - |
| | 45-55 | 18 (30.0) | 40 (66.7) | 2 (3.3) | - |
| | 55-65 | 2 (20.0) | 8 (80.0) | 0 (0.0) | - |
| Gender | Female | 82 (34.5) | 140 (58.8) | 16 (6.7) | ^b 0.001** |
| | Male | 44 (24.4) | 136 (75.6) | 0 (0.0) | |
| Type of physicians | Family medicine resident | 48 (32.4) | 88 (59.5) | 12 (8.1) | ^b 0.001** |
| | Contracted family medicine specialist | 22 (24.4) | 68 (75.6) | 0 (0.0) | - |
| | Family physicians | 40 (28.2) | 102 (71.8) | 0 (0.0) | - |
| | Family medicine specialist | 16 (42.1) | 18 (47.4) | 4 (10.5) | - |
| Work place | Family medicine center | 66 (26.8) | 180 (73.2) | 0 (0.0) | ^b 0.001** |
| | Hospital | 60 (34.9) | 96 (55.8) | 16 (9.3) | |
| Tenure (years) | 0-10 | 86 (31.6) | 172 (63.2) | 14 (5.1) | ^a 0.019* |
| | 10-20 | 30 (37.5) | 50 (62.5) | 0 (0.0) | - |
| | 20-30 | 8 (14.8) | 44 (81.5) | 2 (3.7) | - |
| | >30 | 2 (16.7) | 10 (83.3) | 0 (0.0) | - |

^aFisher-Freeman-Halton test, ^bPearson chi-square test, *p<0.05, **p<0.01

risk of mucosal disruption. Except for these patients, they strongly recommend that ASB not be screened or treated with antimicrobials (12).

Studies have shown that the prevalence of this inappropriate treatment ranges from 45% to 83% (17). The American Geriatrics Society and the American Foundation of Internal Medicine reported the unnecessary use of antimicrobials for ASB as one of the top five overused services in the "Choose Wisely Campaign" (18). In our study, the findings showed that the rate of inappropriate requests for urinalysis and culture was high. It was seen that high rates of urine examination were requested in cases where screening was not recommended, such as the presence of a urinary catheter, advanced age, and chronic disease. Given that 91.3% (n=398) of the physicians stated that they would administer treatment to patients who had (+) infection in urinalysis or culture and did not have urinary symptoms, inappropriate treatment is generally administered based on simple urine measurement strip results.

Urinalysis or microbiology cannot distinguish ASB from symptomatic UTI. Therefore, guidelines recommend the

presence of two or more signs of UTI (such as dysuria, urgency urinate, frequent urination, flank pain or suprapubic pain) as the most accurate indication for diagnosis. Guidelines are against the use of urine dipstick tests and recommend urine culture only if there are signs and symptoms for prescribing antibiotics (19). The UK's National Institutes of Health and Clinical Excellence quality standard for elderly adults (QS260) also recommends diagnosing UTI with a complete clinical evaluation rather than urine test result due to varying accuracy (20).

If the urinalysis or culture is positive, it has been stated that 79.9% (n=318) of the participants used fosfomycin in the treatment, 44.7% (n=178) nitrofurantoin, 21.1% (n=84) cephalosporin, 21.1% (n=84) used quinolones, 13.6% (n=54) sulfonamides, 3.5% (n=14) penicillin and 6% (n=24) other agents. Fosfomycin and nitrofurantoin, which should be used as the first choice for treating uncomplicated UTI according to the guidelines, were also the most preferred agents in our study. Although appropriate agents are preferred regarding approach to the infection, it makes us think that the main problem here is the necessity of

diagnosing UTI and correcting the choice of treatment. Reasons, such as a lack of clinical distinction between ASB and UTI, presence of non-specific symptoms or comorbid conditions, excessive reliance on urinalysis with pyuria/nitrite positivity/high bacterial counts, are important in explaining overtreatment. In another survey of physicians, decision-making based solely on laboratory findings was the most common reason for overtreatment (4,21-23).

In the first step, ASB treatment can only be considered an appropriate approach for pregnant women. In the evaluation made regarding demographic characteristics, the rate of appropriate approach in primary care physicians with relatively high tenure was significantly lower than in other physicians. Additionally, the rate of appropriate treatment by family physician specialists was significantly higher than that with CFMS. Unnecessary treatment rates of those who worked in the CFMS program and family physicians were significantly higher than those of family medicine residents and specialists. In this respect, it is seen that continuing education and following the guidelines are important regarding an appropriate approach.

In a systematic review investigating the inappropriate management of patients with ASB, it was reported that most interventions aimed at minimizing the rate of improper treatment were successful and resulted in a 25%-80% decrease in improper treatment (5). Over-reliance on urinalysis appears to result in improper antibiotic prescribing for ASB. Interestingly, difficulties in reducing inappropriate treatment of ASB can be overcome, as relatively simple interventions (educational and/or organizational) reduce the rate of improper antimicrobial prescribing.

CONCLUSION

In conclusion, clinical practice in the approach to ASB appears to be in significant discord with evidence-based guidelines. Most cases of overtreatment of ASB underlie the approach based on laboratory results rather than the patient's clinical condition. The available evidence suggests that a combination of educational and organizational interventions would help improve the distinction between symptomatic urinary infection and ASB and adherence to evidence-based guidelines, and that ASB should be in a priority group for antimicrobial management programs.

ETHICS

Ethics Committee Approval: The methodology and questionnaire for this study were approved by the of University of Health Sciences Turkey, Bakırköy Dr. Sadi Konuk

Training and Research Hospital Ethics Committee (decision no: 2021-04-15, date: 15.02.2021). The authors assert that all procedures contributing to this work comply with the ethical standards of Bakırköy Dr. Sadi Konuk Training and Research Hospital and the Helsinki Declaration of 1975, as revised in 2008.

Informed Consent: The participants' consent to participate in the study was requested personally from each individual.

Authorship Contributions

Concept: H.P., Ö.P., A.İ.T., Design: H.P., Ö.P., S.K., İ.E., A.İ.T., Data Collection or Processing: H.P., Ö.P., S.K., İ.E., T.K., Analysis or Interpretation: H.P., Ö.P., T.K., A.İ.T., Literature Search: H.P., S.K., İ.E., Writing: H.P., Ö.P., T.K., A.İ.T.

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REFERENCES

1. Nicolle LE, Bradley S, Colgan R, Rice JC, Schaeffer A, Hooton TM; Infectious Diseases Society of America; American Society of Nephrology; American Geriatric Society. Infectious Diseases Society of America guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults. *Clin Infect Dis* 2005;40:643-54.
2. Fridkin S, Baggs J, Fagan R, Magill S, Pollack LA, Malpiedi P, et al. Vital signs: improving antibiotic use among hospitalized patients. *MMWR Morb Mortal Wkly Rep* 2014;63:194-200.
3. Christian KA, Ijaz K, Dowell SF, Chow CC, Chitale RA, Bresee JS, et al. What we are watching--five top global infectious disease threats, 2012: a perspective from CDC's Global Disease Detection Operations Center. *Emerg Health Threats J* 2013;6:20632.
4. Flokas ME, Andreatos N, Alevizakos M, Kalbasi A, Onur P, Mylonakis E. Inappropriate Management of Asymptomatic Patients With Positive Urine Cultures: A Systematic Review and Meta-analysis. *Open Forum Infect Dis* 2017;4:ofx207.
5. Chowdhury F, Sarkar K, Branche A, Kim J, Dwek P, Nangit A, et al. Preventing the inappropriate treatment of asymptomatic bacteriuria at a community teaching hospital. *J Community Hosp Intern Med Perspect* 2012;2.
6. Hartley S, Valley S, Kuhn L, Washer LL, Gandhi T, Meddings J, et al. Overtreatment of asymptomatic bacteriuria: identifying targets for improvement. *Infect Control Hosp Epidemiol* 2015;36:470-3.
7. Spivak ES, Burk M, Zhang R, Jones MM, Neuhauser MM, Goetz MB, et al. Management of Bacteriuria in Veterans Affairs Hospitals. *Clin Infect Dis* 2017;65:910-7.
8. Suda KJ, Hicks LA, Roberts RM, Hunkler RJ, Danziger LH. A national evaluation of antibiotic expenditures by healthcare setting in the United States, 2009. *J Antimicrob Chemother* 2013;68:715-8.
9. Schumock GT, Li EC, Suda KJ, Matusiak LM, Hunkler RJ, Vermeulen LC, Hoffman JM. National trends in prescription drug expenditures and projections for 2014. *Am J Health Syst Pharm* 2014;71:482-99.
10. Shapiro DJ, Hicks LA, Pavia AT, Hersh AL. Antibiotic prescribing for adults in ambulatory care in the USA, 2007-09. *J Antimicrob Chemother* 2014;69:234-40.
11. Fleming-Dutra KE, Hersh AL, Shapiro DJ, Bartoces M, Enns EA, File TM Jr, et al. Prevalence of Inappropriate Antibiotic

- Prescriptions Among US Ambulatory Care Visits, 2010-2011. *JAMA* 2016;315:1864-73.
12. Nicolle LE, Gupta K, Bradley SF, Colgan R, DeMuri GP, Drekonja D, et al. Clinical Practice Guideline for the Management of Asymptomatic Bacteriuria: 2019 Update by the Infectious Diseases Society of America. *Clin Infect Dis* 2019;68:e83-110.
 13. Nicolle LE. Asymptomatic bacteriuria: when to screen and when to treat. *Infect Dis Clin North Am* 2003;17:367-94.
 14. Courjon J, Pulcini C, Cua E, Risso K, Guillouet F, Bernard E, et al. Antibiotics-related adverse events in the infectious diseases department of a French teaching hospital: a prospective study. *Eur J Clin Microbiol Infect Dis* 2013;32:1611-6.
 15. Wullt B, Svanborg C. Deliberate Establishment of Asymptomatic Bacteriuria-A Novel Strategy to Prevent Recurrent UTI. *Pathogens* 2016;5:52.
 16. Cai T, Mazzoli S, Mondaini N, Meacci F, Nesi G, D'Elia C, et al. The role of asymptomatic bacteriuria in young women with recurrent urinary tract infections: to treat or not to treat? *Clin Infect Dis* 2012;55:771-7.
 17. van Horrik TM, Geerlings SE, Stalenhoef JE, van Nieuwkoop C, Saanen JB, Schneeberger C, et al. Deimplementation strategy to reduce overtreatment of asymptomatic bacteriuria: a study protocol for a stepped-wedge cluster randomised trial. *BMJ Open* 2021;11:e039085.
 18. Choosing Wisely. An initiative of the ABIM foundation. Available at: <http://www.choosingwisely.org/societies/american-geriatrics-society/>. [Accessed 23.10.2021].
 19. SIGN, 2012. Scottish Intercollegiate Guidelines Network (SIGN). Management of suspected bacterial urinary tract infection in adults. (SIGN Publ. no. 88) 1-52. Available at: <https://www.sign.ac.uk/assets/sign88.pdf>. [Accessed 13.11. 2021].
 20. NICE, 2015. National Institute for Health and Care Excellence: Urinary tract infections in adults. Available at: <https://www.nice.org.uk/guidance/qs90/chapter/quality-statement-1-Diagnosing-urinary-tract-infections-in-adults-aged-65-years-and-over>. [Accessed 28.11.2021].
 21. Drekonja DM, Gnadt C, Kuskowski MA, Johnson JR. Urine cultures among hospitalized veterans: casting too broad a net? *Infect Control Hosp Epidemiol* 2014;35:574-6.
 22. Walker S, McGeer A, Simor AE, Armstrong-Evans M, Loeb M. Why are antibiotics prescribed for asymptomatic bacteriuria in institutionalized elderly people? A qualitative study of physicians' and nurses' perceptions. *CMAJ* 2000;163:273-7.
 23. Eyer MM, Läng M, Aujesky D, Marschall J. Overtreatment of asymptomatic bacteriuria: a qualitative study. *J Hosp Infect* 2016;93:297-303.