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REVIEW PAPER

UNUSUAL SYMPTOMS AND SERIOUS CONSEQUENCES: URINARY TRACT INFECTIONS IN OLDER ADULTS

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Summary

Urinary tract infections (UTIs) are one of the most common bacterial infections. They are frequent in older people due to age-related risk factors and comorbidities. Non-specific symptoms occurring in patients over 65 years of age are often confused with other ailments characteristic of this age group. A significant problem in the treatment of UTIs is the overuse of antibiotics, which contributes to the increase in the incidence of multidrug-resistant bacteria; therefore, it is important to use prophylaxis to prevent the development of infection. This review

aims to present the clinical picture and risk factors for UTIs in older people, as well as present methods of prevention. The work represents the latest epidemiological data and scientific research findings available in the PubMed and Google Scholar databases, as well as the websites of the World Health Organization (WHO) and the European Association of Urology (EAU). The articles were selected based on keywords such as: "urinary tract infection", "elderly", "postmenopausal women", and similar, with the main scope of the search covering publications published in 2011-2025.

Keywords: postmenopausal women, urinary tract infections, palliative care, risk factors, elderly

Introduction

Urinary tract infections (UTIs) are amongst the most common bacterial infections, placing a huge burden on healthcare systems. They affect approximately 150 million people worldwide every year [1]. *Escherichia coli* (*E. coli*) is the most frequently isolated pathogen in UTIs. Although the patient's place of residence does not affect the frequency of isolation of this species, differences in the antibiotic resistance profile of bacteria are related to environmental conditions and the specificity of a given population. UTIs are the most common diagnoses among older people, both in the case of nosocomial and community-acquired infections [2]. Moreover, older people, due to difficulties in describing their symptoms, are more likely to suffer from late diagnosis or completely undiagnosed UTIs [3].

Aim of the work

The purpose of this article is to summarize the current knowledge of UTIs in older adults and to present the main risk factors and methods of prevention related to UTIs in the geriatric population.

Methods

The literature review was conducted by analyzing domestic and foreign publications available in the PubMed and Google Scholar databases, as well as the websites of the World Health Organization (WHO) and the European Association of Urology (EAU). The articles were selected based on keywords such as: "urinary tract infection", "elderly", "postmenopausal

women", and "urinary catheterization". The inclusion of the term postmenopausal women reflects their significantly increased susceptibility to UTIs due to estrogen deficiency, reduced vaginal colonization with *Lactobacillus* species, increased vaginal pH, and subsequent susceptibility to uropathogen colonization. Keywords were aligned with Medical Subject Headings (MeSH) terminology to improve the precision and relevance of the search. Urinary catheterization was included as a keyword because using a catheter significantly increases the risk of UTIs in older adults. The main scope of the search covered publications in 2011-2025, with particular emphasis on articles no older than five years. Three independent reviewers conducted the literature search and screening process, and decisions regarding eligibility were made by consensus. No dedicated software tools were used, and all searches were performed manually using the above-listed databases.

Literature review results

What are UTIs?

In general, UTIs account for 40-50% of all nosocomial infections and 10-20% of community-acquired infections and are responsible for 30% of sepsis cases [4,5]. They constitute a group of the most frequently diagnosed bacterial infections. They are caused by pathogens such as *Escherichia coli, Klebsiella pneumoniae, Proteus mirabilis, Enterococcus faecalis*, and *Staphylococcus saprohyticus. E. coli* is responsible for 75-95% of uncomplicated infections, while in complicated infections, its share decreases to 40-50%, which is accompanied by an increase in the incidence of pathogens such as *Enterobacter* spp., *Acinetobacter* spp., and *Pseudomonas* spp. [1,6,7]. Moreover, *E. coli* is the dominant pathogen in patients with an indwelling catheter [8]. UTIs most commonly follow an ascending pathway. Bacteria found in the perineum enter the urethra and then migrate towards the bladder. If the infection is not controlled at this stage, the bacteria may move higher towards the kidneys, which may ultimately result in a systemic infection [9]. The common clinical definitions related to UTIs are presented in Table 1.

Table 1. Clinical conditions in UTI [10]

Condition	Description
UTI	Presence of pathogens in the urinary tract accompanied by symptoms.
Bacteriuria	Presence of bacteria in the urine $\geq 10^5$ CFU/ml, may be symptomatic or asymptomatic depending on clinical presentation.
Asymptomatic bacteriuria	Presence of bacteria in the urine $\geq 10^5$ CFU/ml without symptoms of genitourinary infection.
Uncomplicated UTI	UTI occurring in a patient without structural or functional abnormalities of the urinary tract and without relevant comorbidities.
Complicated UTI	UTI present in a patient with a structural or functional abnormality of the urinary tract, or with comorbidities that increase the risk of treatment failure.
Recurrent UTIs	Two or more symptomatic UTIs within six months, or three (or more) within twelve months.
Urosepsis	Life-threatening complication of infections originating in the urinary tract.

The development of UTIs is influenced by both virulence factors of the bacteria and the patient's physiological conditions. *E. coli*, the most common uropathogen, has the ability to express fimbriae on its surface, which enable it to adhere to epithelial cells and form a bacterial biofilm. In addition, *E. coli* can produce numerous toxins such as α-hemolysin, uropathogenic specific protein, and cytotoxic necrotizing factor 1, which enable the bacteria to invade host cells, as well as a polysaccharide capsule that protects the bacteria against phagocytosis and the effects of the immune system [11]. The mechanisms that uropathogens use are extremely complex and demonstrate continuous evolutionary development. An interesting phenomenon is the loss of virulence factors by bacteria in favor of acquiring genes related to antibiotic resistance, which shows that once the bacteria manage to overcome the host's immune system, they focus on remaining resistant to antibiotics [12].

A bacterial biofilm is a large-cellular structure composed of microorganisms embedded in a polysaccharide matrix. In the context of UTIs, biofilm can form both on the bladder mucosa and on the surfaces of biomaterials such as urinary catheters. This is the cause of recurrent and persistent infections, as the bacteria residing there are much more resistant to antibiotics [13]. Moreover, many uropathogens also have the ability to survive inside bladder epithelial cells, creating intracellular bacterial communities (IBCs), resembling bacterial biofilms in their structure [14]. After reaching maturity in the IBCs, the bacteria escape from the cell in which they multiplied and infect neighboring epithelial cells. However, some bacteria may enter a dormant form and reside in quiescent intracellular reservoirs (QIRs) in deeper tissue layers.

OIRs are present in the body for up to 12 weeks, thanks to which, under favorable conditions, bacteria can begin to expand again [15].

UTI – symptoms, diagnosis and treatment

According to the findings of the WHO, the period of old age begins at the age of 65 [16], but diagnosing UTIs in older people is based on similar criteria as in the case of young people. UTIs are diagnosed based on the results of laboratory tests, in which the number of bacteria in urine is above $\geq 10^5$ CFU/ml in the case of asymptomatic patients, asymptomatic patients constantly catheterized, people suffering from complicated UTIs, or in the case of recurrent uncomplicated infections in women. Among men and symptomatic patients with permanent catheterization, UTIs may be diagnosed $\geq 10^3$ CFU/ml [4,17]. The detection of bacteria in urine in the absence of genitourinary symptoms is referred to as asymptomatic bacteriuria [18]. An uncomplicated UTI affects the area of the urinary bladder and related structures in people without existing diseases and/or defects of the urinary tract and is caused by typical bacteria. In individuals with a properly functioning immune system, the infection may be resolved spontaneously. Unfortunately, the efficiency of the immune system decreases with age, which may lead to acquired immune deficiency, increasing the risk of developing UTIs [19].

UTIs can have a very diverse clinical picture, from the above-mentioned asymptomatic infection to severe urosepsis. Typical symptoms of lower UTI, which are also diagnosed in older people, include painful urination, frequent urination, nocturia, emerging or worsening urinary incontinence, and bladder pain. Importantly, chronic urinary incontinence may make it difficult to distinguish mild asymptomatic bacteriuria from symptomatic UTIs in older adults. Heavy urination (lasting <1 week) most effectively predicted laboratory confirmation of UTI [10]. In case of infection of the upper urinary tract, fever, rigors, nausea, and vomiting may also occur. However, the correct diagnosis of UTIs in older people is challenging due to the atypical symptoms occurring in this age group. Older adults may present with non-specific or atypical symptoms of UTI, which often occur in the absence of classic urinary complaints. Such clinical presentations result from age-related physiological changes, multiple comorbidities, polypharmacy and impaired immune response [20]. The most frequently described atypical manifestations include acute confusion or delirium, often accompanied by fluctuating levels of consciousness; new or worsening disorientation; reduced alertness or increasing drowsiness; unexplained falls or gait disturbances; and a progressive decline in functional status, including

loss of mobility or a reduced ability to perform daily activities [21]. Some patients may also experience decreased appetite, nausea, eating disturbances, general weakness, fatigue, or malaise, as well as new or worsening urinary incontinence [22]. Behavioral changes, such as agitation, irritability, or withdrawal, are also common, and in severely frail patients, a sudden deterioration of overall condition may be observed [20]. Due to their non-specific nature, these symptoms cannot independently confirm a UTI, as they may also result from dehydration, adverse drug effects, metabolic disturbances, or other infections. For this reason, a comprehensive clinical assessment supported by urinalysis and urine culture is essential to avoid misdiagnosis and unnecessary antibiotic treatment [23]. For patients who are in good mental and physical condition and describe their symptoms well, the diagnosis of a UTI is easier. The lack of a clear message from an elderly patient means that it is necessary to collect additional information from the closest family members or caregivers. Studies among older adults in primary care showed that UTI was the second most common infection that was initially misdiagnosed [24], leading to unnecessary exposure to antibiotics and delay in making the correct diagnosis [18]. The results of Caterino et al. [25] showed that the Centers for Disease Control and Prevention (CDC) guidelines are not sufficient for assessing UTIs in older people.

Pharmacological treatment is preventive against the spread of infection towards the upper urinary tract [26]. The drugs of first choice for uncomplicated UTIs are trimethoprim, co-trimoxazole, and fosfomycin. Second-choice drugs are mainly antibiotics belonging to the fluoroquinolone group, but they should be avoided in empirical treatment and used only when necessary, as their overuse contributes to the increase in drug resistance among microorganisms. Moreover, treatment with fluoroquinolones should primarily be used for conditions other than cystitis, including complicated infections or severe clinical conditions. Complicated UTIs usually require longer courses of antibiotics. In such patients, in addition to fluoroquinolones, it is recommended to administer aminopenicillin with a beta-lactamase inhibitor, third-generation cephalosporins or aminoglycosides. A factor that should be additionally taken into account when prescribing antibiotic therapy in older people is the reduced absorption of oral drugs and possible interactions with other drugs taken [27]. It is also necessary to carefully inform the patients about the need to follow medical recommendations, and if they are not fully independent, they should contact their family and/or guardian. Additionally, patients are advised to rest and adequately replenish fluids. If the diagnosis of symptomatic UTI is in doubt, antibiotic therapy may be postponed while supportive therapy such as increased fluid intake is offered. In case of therapeutic failure, the UTI may lead to severe urosepsis, which seriously threatens the health and life of elderly patients [28].

Risk factors for UTIs in older people

UTIs are a common health problem among older people. The incidence of UTIs increases with age by approximately 1% per decade, and approximately 10% of women over the age of 70 suffer from UTIs. Approximately 50%-70% of women experience a UTI at least once in their life, and 20%-30% will experience a recurrence of the disease [29]. Moreover, the prevalence of asymptomatic bacteriuria is approximately 3.5% in the general population but increases to 18-25% (in some sources even up to 50%) in women over 70 years of age [10]. The most important risk factors contributing to the development of UTIs in older adults are summarized in Figure 1.

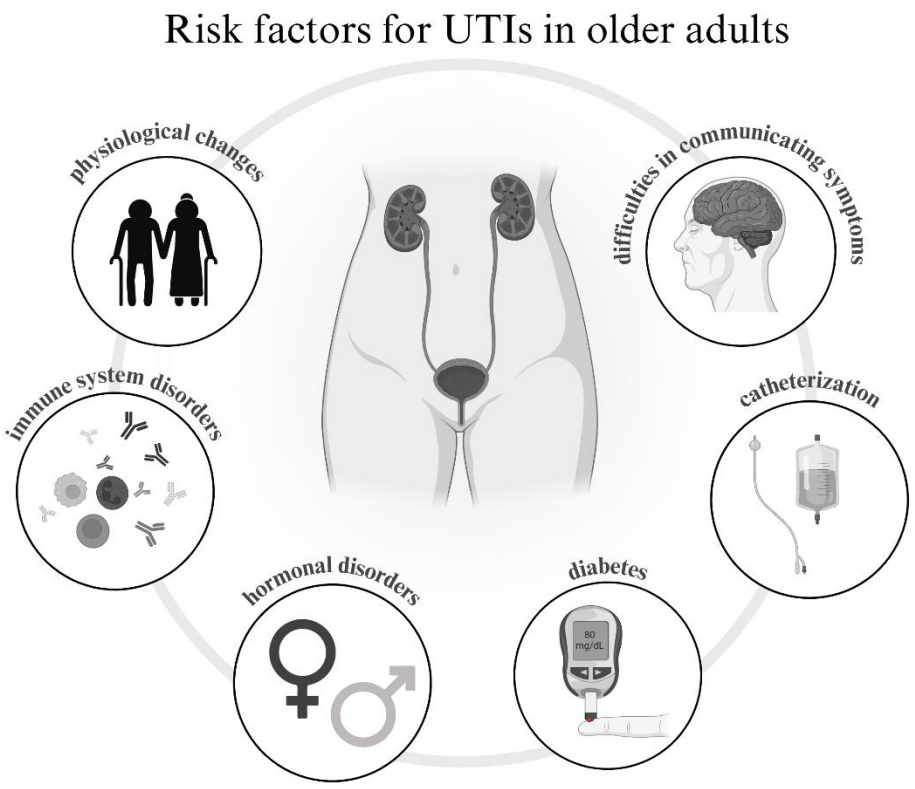

Figure 1. Risk factors for UTIs in older adults
Notes: own elaboration – created in BioRender (https://BioRender.com/t98p147).

Studies have shown that with age, bladder capacity decreases, urethral pressure and urine flow rate decrease, and the number of uninhibited contractions increases [10,30]. Elderly patients, often with additional dysfunctions such as cognitive impairment, limited mobility, or complete immobilization, are particularly at risk of developing UTIs. This is dictated by physiological and morphological changes that occur during the aging process of the body, which

ultimately increase susceptibility to infections and the overgrowth of pathogenic bacteria of the urinary tract [31]. In mature people, we also observe the phenomenon of immunosenescence, i.e. the aging of the immune system, which significantly reduces the effectiveness of the body's defense against microorganisms [32]. These changes occur gradually and are a complex process. Research shows that one of the main effects of immunosenescence is a reduction in the number of immune system cells, including virgin T lymphocytes, responsible for recognizing and eliminating pathogens, and B lymphocytes, responsible for the production of antibodies. As a result of abnormal secretion of cytokines, pro- and anti-inflammatory processes are deregulated. In older people, increased levels of IL-6, TNF-α, and IL-17 are observed, with a simultaneous decrease in IL-10 and IFN-γ, which may lead to chronic, subthreshold inflammation [33]. This phenomenon is associated with the occurrence of neurodegenerative diseases, heart diseases, and diabetes [33,34]. Autoimmune processes intensify and may lead to tissue and organ damage [33,35]. As a result, an older person's immune system may have more trouble fighting off an infection than it would in a younger person.

Seniors suffering from Alzheimer's disease or dementia have limited cognitive and functional abilities, which progress with age and result in difficulties in communicating symptoms and ailments. Maintaining proper hygiene is difficult in such patients, especially in those living alone or with limited additional care. In people with advanced dementia, the ability to control the urinary bladder and intestines decreases, which, together with limited motor mobility, contributes to an increased risk of developing UTIs [36].

Urinary incontinence is common among the discussed group of patients and has a significant impact on the occurrence of UTIs. When urine leaks from the lower urinary tract, it creates the perfect environment, acting as a breeding ground for bacteria to grow and enter the urinary tract [19,37]. It is estimated that 40-60% of women will experience a UTI at least once in their lives, and half of them will experience a recurrence of UTI within one year [28]. The risk of UTIs in women is higher due to the presence of a shorter urethra and proximity to the anal sphincter, which significantly reduces the distance that bacteria must traverse to reach the urinary bladder and initiate infection [38]. The main factors predisposing to an increased occurrence of UTIs in older women are hormonal changes occurring during menopause and postmenopause and aging of connective tissue, which may result in urinary incontinence and pelvic organ prolapse [39]. In menopausal women, estrogen levels decrease, which causes disturbances in the functioning of the vaginal epithelium, leads to lower glycogen production and, consequently, to lower production of lactic acid bacteria and an increase in vaginal pH. As a result of these changes, the vagina becomes an environment more susceptible to colonization

with pathogenic bacteria [19,39]. Genitourinary menopausal syndrome (GSM) includes all symptoms associated with decreased estrogen levels and may involve the genital tract and lower urinary tract [40]. Local (vaginal) use of estrogens significantly reduces the risk of bacteriuria and recurrent UTIs [41].

Benign prostatic hyperplasia (BPH) is the leading cause of lower urinary tract obstruction in men [42]. On average, 50% of men over the age of 60 and 80% of men over the age of 80 experience urinary tract symptoms caused by BPH [43]. Post-void urine retention and urinary stasis resulting from chronic obstruction contribute to the development of asymptomatic bacteriuria and UTIs in older men [19,44]. The causes of BPH include hormonal changes, including a decrease in testosterone levels, genetic factors, as well as an inappropriate lifestyle and the growth of adipose tissue [43]. In order to improve the quality of life, patients are advised to avoid caffeine and alcohol, drink adequate fluids, and relax. Pharmacological treatment should be considered depending on the patient's symptoms and burden [45].

According to research, diabetes is common among people over 65 years of age [46]. In such patients, bacteriuria and UTIs occur more often than in healthy people, and the treatment duration should be extended. Moreover, in the discussed group, there is a higher risk of asymptomatic involvement of the kidneys or prostate gland, the frequency of UTIs recurrences increases, and their course is more severe [47]. The condition for more effective therapy is proper metabolic control and the absence of glucose in the urine, as sugar is an excellent medium for the development of bacteria. The most serious complications observed in patients with diabetes include perirenal abscess and renal papillary necrosis [48]. Moreover, patients with diabetes often suffer from autonomic neuropathy, which results in bladder and urination dysfunction, reducing their physical ability to remove bacteria and thus facilitating their growth [49].

According to research, 39% of dementia patients experience at least one UTI annually [50]. This population is particularly vulnerable due to cognitive impairment, difficulties in recognizing symptoms, and a higher likelihood of atypical presentations, which may lead to overdiagnosis and inappropriate antibiotic use [50,51]. Progressive functional decline and reduced bladder control further increase susceptibility to infection, especially in institutionalized patients. Challenges in maintaining hygiene and managing urinary incontinence, combined with limited mobility, additionally elevate the risk of bacteriuria and UTIs in this group [19,37]. The key factors influencing urination in patients receiving palliative care are presented in Table 2.

Table 2. Factors affecting urination in patients receiving palliative care [52]

Factor	Description
Treatment and pharmacological factors	Sedatives and strong painkillers can affect a patient's ability to recognize the need to urinate; oncological treatment, including chemotherapy and radiation therapy, can lead to bladder irritation, bladder spasm, hemorrhagic irritation.
Surgery	Surgical procedures involving the urethra, such as prostatectomy, or operations that indirectly affect the urethra, like hysterectomy, may lead to internal sphincter dysfunction, resulting in urinary incontinence.
Constipation or stool retention	Constipation is common among palliative patients, primarily due to limited mobility, dehydration, bowel motility disorders, and metabolic slowing; it has a negative impact on bladder function due to the close anatomical and neurological relationship between the bladder and intestines.
Restricted mobility	Severe pain and shortness of breath can significantly impair the ability to use the toilet and maintain personal hygiene; additionally, the disease itself may lead to weakness or exhaustion.
Neurological factors	Neurogenic bladder or neurogenic urinary tract dysfunction are terms referring to bladder dysfunction caused by neurological damage; they can be associated with either the terminal disease itself or with long-term comorbidities.

The use of a urinary catheter in adults and elderly people is a common practice in emergency departments and hospitals, but in up to 30-50% of patients, it may not be medically indicated, and the catheterization time is prolonged [53]. The catheter surface is an excellent place for bacteria to colonize and create a biofilm, which favors the development of infection [54]. Therefore, in hospitalized patients or patients with long-term catheters, the risk of UTIs increases significantly. 80% of hospital UTIs cases are the result of the presence of a catheter in the bladder, and the incidence of UTIs increases by approximately 3-10% for each day the catheter is in place [47,55]. In patients with symptoms of UTI, continuously or intermittent catheterization, a result of bacteriuria above 10^3 CFU/ml is considered significant [41]. In order to avoid diagnostic errors, the culture material must be collected through a freshly inserted catheter. Factors contributing to infection include prolonged catheter maintenance time and lack of aseptic techniques during catheter insertion [50]. In case of catheterization, the percentage of UTIs caused by Gram-positive bacteria increases [27].

Prevention

UTIs are the most common reason why doctors prescribe antibiotics. Rotjanapan et al. [56] and D'agata et al. [57] in their studies showed that 40-75% of antibiotic prescriptions are unnecessary. This practice causes the incidence of multidrug-resistant bacteria to significantly increase. Due to the increasing number of cases of antibiotic overuse, the use of preventive measures is a key issue in the care of older patients. In patients at risk of UTI, adequate fluid intake is extremely important to increase the frequency of micturition. Patients should also remember to practice proper personal hygiene, wear breathable underwear, and wipe in the correct direction (from front to back). In patients requiring placement of a urinary catheter, the duration of catheterization should be as short as possible. If the catheter is used long-term, the need for continued use should be periodically reassessed [58,59]. Proper care of the catheter is also important to prevent unnecessary mechanical injuries to the genitals and urethra. Early recognition of catheter occlusion helps minimize the risk of UTI and potential subsequent systemic infections [27,48].

A recognized method of preventing UTIs is immunoprophylaxis. Studies have shown that oral immunotherapy based on a lyophilized lysate of 18 serotypes of inactivated *E.coli* bacteria is an effective and safe method of preventing recurrent UTIs. This preparation is administered orally and contains a standardized lysate of uropathogenic *E.coli* [60]. In menopausal women, the number of recurrences of infections decreased by 65% after such treatment [39]. For older people, a sublingual bacterial vaccine containing an inactivated mixture of *E.coli*, *Klebsiella pneumoniae*, *Proteus vulgaris*, and *Enterococcus faecalis* may be more convenient to administer. This preparation is delivered as a sublingual spray and includes the species most commonly responsible for the UTIs [61]. Both preparations exert an immunomodulatory effect and enhance the host immune response against uropathogens. Conflicting research results concern the positive effect of probiotics on the prevention of UTIs. The highest effectiveness has been recorded for specific strains of lactobacilli, including *Lactobacillus rhamnosus* GR-1, *Limosilactobacillus reuteri* B-54 and RC-14, *Lacticaseibacillus casei* (strain *Shirota*), and *Lactobacillus crispatus* CTV-05 [60]. However, according to the 2023 guidelines of the EAU, the available studies are limited in number, are heterogeneous, and are often of insufficient methodological quality, which does not allow for clear recommendations regarding the optimal route of administration, dosage, or duration of therapy [60]. Key elements of the diagnostic and therapeutic management of UTIs in older adults are summarized in Table 3.

Table 3. Management of UTIs in older adults [20,62]

Management step	Description
Does the patient have clinical symptoms of UTI?	Urinary tract symptoms or unusual symptoms, while also considering alternative sources of infection.
Diagnosis of UTI	Clinical history and urine testing (urinalysis and urine culture).
Treatment	Administer empirical antibiotics and adjust therapy based on urine culture results; if culture results are negative, discontinue antibiotics and investigate other potential causes.
Supportive care	Monitoring of general condition, including cognitive status, hydration, and overall functional health; increased fluid intake is recommended unless contraindicated.
Comorbidities	Comorbidities increase the risk of recurrent UTIs; effective management of diabetes and assessment of structural or functional urogenital abnormalities is important.
Prevention	Maintaining good general and intimate hygiene, ensuring adequate hydration, and avoiding risk factors such as permanent catheterization.

Conclusions

Diagnosing symptomatic UTIs in older people still poses a serious challenge for physicians to care for this group. Guidelines are available to aid in the diagnosis, though overprescription of antibiotics remains a significant problem. Correct diagnosis of UTIs may be difficult in older patients with cognitive impairment. In this group, the risk of UTI and its recurrence increases due to the reduced immune efficiency and multiple comorbidities. Diabetes is common among people aged 60-79 years and represents an important risk factor for UTIs. In menopausal women, the prevalence of UTIs increases due to estrogen deficiency. Individuals with urinary incontinence who have difficulty maintaining proper hygiene are particularly susceptible to UTIs. An appropriate approach to managing comorbidities, addressing urinary incontinence, and using well-chosen antibiotic therapy and preventive strategies forms the foundation for reducing the risk of UTIs in older adults.

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