Womens' self-management skills for prevention and treatment of recurring urinary tract infection

Lelie-van der Zande, R.; Koster, E.S.; Teichert, M.; Bouvy, M.L.

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Womens' self-management skills for prevention and treatment of recurring urinary tract infection

Rian Lelie-van der Zande[1] | Ellen S. Koster[1] | Martina Teichert[2] | Marcel L. Bouvy[1]

[1]Department of Pharmacoepidemiology and Clinical Pharmacology, Utrecht Institute for Pharmaceutical Sciences, Utrecht University, Utrecht, The Netherlands

[2]Department of Clinical Pharmacy and Toxicology, Leiden University Medical Center, Leiden, The Netherlands

Correspondence
Rian Lelie-van der Zande, Department of Pharmacoepidemiology and Clinical Pharmacology, Utrecht Institute for Pharmaceutical Sciences, Utrecht University, Universiteitsweg 99, 3584 CG Utrecht, The Netherlands.
Email: a.c.a.lelie-vanderzande@uu.nl

Abstract

Background: The guideline on urinary tract infections (UTI) of the Dutch College of General Practitioners provides recommendations on patient-initiated treatment and prevention of recurring UTI.

Aim: To study familiarity with self-management skills for prevention of recurring UTI amongst adult women.

Design and settings: An online questionnaire was developed, based on the UTI guideline and interviews with women having recurring UTI. Pharmacists in a postgraduate education programme (N = 76) aimed to invite 10 adult women with a recurring UTI prescription to complete the questionnaire. Women were asked for informed consent to link medication record data to questionnaire data.

Method: We calculated proportions of the scores for self-management skills and analysed differences between age groups with chi-square test.

Results: Complete questionnaires were available for 719 women (mean age 55.1 ± 18.5 years). The proportions of women 18-50 years and women 51 years or older were 36.4% and 63.6%, respectively. Education levels of women 18-50 years were significantly higher than those of women 51 years and older. Before consulting a general practitioner (GP) for symptoms, 32.1% of all women increased fluid intake; additionally, 15.0% used analgesics and increased fluid intake. Of all women, 33.9% searched internet for information on self-management and 18% occasionally received a prescription for patient-initiated treatment, half of these prescriptions for use during vacation. Cranberry was used by 47%, d-mannose by 5% and vitamin C by 29% of all women. Awareness of different preventive behavioural measures (eg, fluid intake, washing without soap and emptying bladder after sexual intercourse) varied between 20% and 90%.

Conclusion: Almost half of all women applied self-management (increased fluid intake, analgesics) before consulting a GP for recurring UTI. Awareness of preventive behavioural measures for recurring UTI varied considerably. Thus, education of women about the use of analgesics and behavioural measures deserves attention.

1 | INTRODUCTION

Uncomplicated urinary tract infections (UTI) are amongst the most common acute presentations for women in primary care.[1] During their lifetime, 40% to 60% of women are at least once diagnosed and treated for a UTI, with most being diagnosed for the first time before the age of 25.[2,3] Approximately one third of women experience at least one recurring UTI, often within 3 months after the first episode.[4] In 2017, UTI was the most frequent indication for a general practitioners' (GP) prescription of an antibiotic in the Netherlands.[5]

In most women, UTIs are accompanied by symptoms such as dysuria, urgency, frequent urination, suprapubic pain and hematuria.[6] In postmenopausal women, however, genitourinary symptoms are not necessarily related to uncomplicated UTI.[7] The diagnosis of uncomplicated UTI can be made with a high probability based on a history of lower urinary tract symptoms (dysuria, frequency and urgency) and the absence of vaginal discharge.[7,8] In 25% to 50% of symptomatic women not taking antibiotics, symptoms recover spontaneously within 1 week.[9] More than a third of women with UTI symptoms were willing to delay antibiotic treatment when asked by their GP.[9] In addition, women themselves may prevent recurrence of UTI.

Recent studies have identified several risk factors for recurring UTI: wiping back to front, delayed or premature voiding, straining to void, not voiding urine within 15 minutes after intercourse, using soap to clean after urination and chronic constipation.[10-13] The 2013 Dutch GP guideline recommended ample fluid intake, complete emptying of the bladder, not postponing micturition, emptying of the bladder soon after intercourse and prophylactic use of cranberry.[14,15] A Cochrane review concluded that there is limited evidence for the benefit of cranberry for preventing recurring UTI.[16] In 2019 the GP guideline was revised. Prophylactic use of cranberry and d-mannose are mentioned as potential preventive measures, in spite of limited evidence.[17,18] Vitamin C has been recommended in the past. Its use was thought to inhibit bacterial growth by acidifying the urine. However, there is inconclusive evidence for the effectiveness of Vitamin C in prevention.[19,20]

Prevention strategies other than antibiotic prophylaxis carry a low risk of adverse effects, do not increase bacterial resistance and should be considered in order to minimise use of antibiotics.[6,7,21-23] Therefore, it is important to know what women already know and do to prevent recurring UTI. However, studies of the perceptions of women on the prevention of recurring UTI are limited.

We studied self-management skills and knowledge of behavioural measures aimed at preventing recurring UTI in adult women (aged 18 years and older).

What's Known

- Qualitative studies of patients' perspectives showed that many women with UTI did not feel they were being heard and that they valued prevention advice.
- If you want to provide women with prevention advice, it is important to know what women already know and do themselves.

What's new

- Almost half of all women applied self-management before consulting a general practitioner for recurring UTI.
- Awareness of preventive behavioural measures for recurring UTI varied considerably.

2 | METHOD

2.1 | Study design

Women were invited for an online survey in 76 Dutch community pharmacies spread across the Netherlands. The pharmacists who participated in the study were enrolled in a postgraduate education programme to specialise in community pharmacy. They invited 10 adult women who visited the pharmacy with a prescription of one of the UTI guideline antibiotics (nitrofurantoin, fosfomycin or trimethoprim) for treatment of uncomplicated UTI. Women who were not proficient in Dutch or never before had UTI were excluded. Moreover, included women were asked for permission to consult their medication record of the preceding 12 months for the number of dispensings of UTI antibiotics. Patients were asked for informed consent regarding the use of the anonymised data in the questionnaire and medication record. For identification of these documents, they received a four-digit research code. The pharmacists kept a secure coding table with the four-digit code and patient identification data in the pharmacy. The researchers had no access to data that could identify individual patients. The researchers communicated with the postgraduate trainees through the coordinator of the curriculum, who acted as a "trusted third person." After 1 month, the pharmacists sent a reminder to patients who had not yet responded. Data were collected between March and July 2018.

2.2 | Data collection

The survey was conducted using an online survey system (Questback Version 27). The women could complete the questionnaire online in this survey tool or via a paper form in the pharmacy. The pharmacists entered data from the paper form into the survey tool. Medication record printouts were screened for the number of dispensings of nitrofurantoin 200 mg for 5 or 7 days, fosfomycin as a one-off dose of 3 g and trimethoprim 300 mg for 3 days.

2.3 | Questionnaire design

The questionnaire was designed after semistructured, face-to-face interviews with three adult women who had recurring UTI. The

interviews were digitally recorded, transcribed verbatim and analysed. Questions were based on these interviews and the recommendations of the 2013 version of the UTI guideline of the Dutch College of General Practitioners.[14] The questionnaire was piloted for clarity, presentation and missing items by two women reading the questionnaire aloud. Main topics in the questionnaire were patient-initiated treatment and self-management strategies. Answers were multiple-choice, open response and a 5-point Likert scale, ranging from totally disagree to totally agree.

2.4 | Data analysis

Descriptive analyses (proportions and means) were calculated. For Likert scale questions, a positive or negative answer was calculated by adding (dis)agree and totally (dis)agree. Considering that symptoms may change with menopause and that differences in education levels may exist, we stratified the results for women 18-50 years and for women 51 years and older. Chi-square tests and independent sample *t*-tests were used to assess statistically significant differences in patient characteristics and outcome between the two age groups. All data were analysed using IBM SPSS for Windows, version 23.0.

3 | RESULTS

3.1 | Response rate and population

Seven hundred forty-three women completed the questionnaire. Of these, 24 were excluded for missing of the four-digit research code or age. Therefore, the study population consisted of 719 women (Table 1). The proportions of women 18-50 years and women 51 years or older were 36.4% and 63.6%, respectively. Education levels of women 18-50 years were significantly higher than those of women 51 years and older.

The analysis for the number of dispensings in the medication record could be performed on a subgroup of 545 women who gave informed consent to consult their medication record and provided a complete medication record of 12 months. Of these women, 49.9% (n = 277) had one or two dispensings in the preceding year. Women 18-50 years had significantly less dispensings than women 51 years and older.

3.2 | Symptoms

The most common symptoms were dysuria, frequent urination and urgency (Figure 1 and Table S1). Recognition of an episode of UTI, based on the symptoms, was reported by 92.9% (n = 668) of all women. Of these women, 48.5% (n = 324) reported a combination of dysuria, frequent urination, and urgency. This combination of symptoms and association with recognition of UTI was significantly more present within women 18-50 years (56.7%) than within older women (43.7%) ($P = .001$). Of all women, 87.6% (n = 630) thought an antibiotic was always necessary when they experienced an episode: 90.6% (n = 414) of women 51 years and older and significantly less in women 18-50 years, with 82.4% (n = 216) ($P = .001$). Of the women with a medication record, 42.2% (n = 234) recognised an episode of UTI based on the three symptoms. Of these women, 42.7% (n = 113) had one or two dispensings in the preceding year.

3.3 | Self-management

Upon first symptoms of UTI, 45.2% (n = 325) of the study population consulted a GP, whereas 32.1% (n = 213) first increased fluid intake before visiting a GP, 15.0% (n = 108) first increased fluid

TABLE 1 Characteristics of participating women with recurring urinary tract infection, stratified for age groups

	All women	Women 18-50 years	Women ≥51 years	*P*-value
All questionnaires				
Number of women	719 (100%)	262 (100%)	457 (100%)	
Mean age (±SD) in years	55.1 ± 18.5	34.2 ± 9.8	67.1 ± 9.5	
Education		*	*	<.001
Primary	35.9% (258)	16.0% (42)	48.3% (216)	
Secondary	36.2% (260)	44.3% (116)	32.2% (144)	
Higher	28.0% (201)	39.7% (104)	21.7% (97)	
Questionnaires of women with medication records				
Number of women	545	194 (35.6%)	351 (64.4%)	
Mean number of self-reported episodes in the preceding 12 months ±SD (range)	3.1 ± 1.4 (0-15)	3.1 ± 1.3 (1-10)	3.2 ± 1.4 (1-15)	
Mean number of dispensings of uncomplicated UTI antibiotics in the preceding 12 months ±SD (range)	3.0 ± 1.9 (0-15)	2.6 ± 1.6** (0-10)	3.2 ± 2.1** (0-15)	<.001

*Statistical significance tested by chi-square test, difference significant if $P < .05$; **Statistical significance tested by independent samples *t*-test, difference significant if $P < .05$.

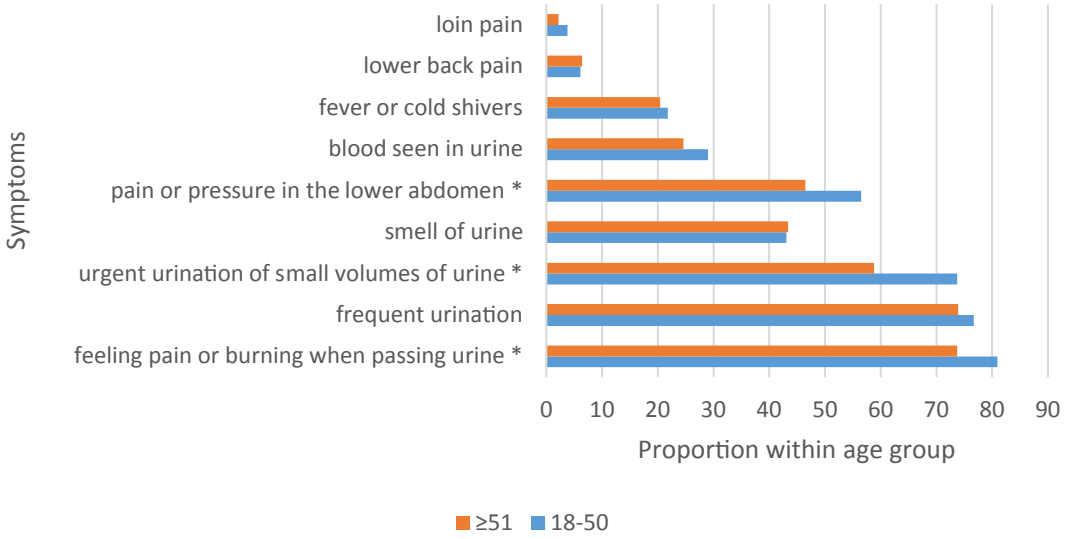

FIGURE 1 Proportions of women within age groups 18-50 and 51 years and older for self-reported symptoms; *statistical significance tested by chi-square test to compare proportions of women within age groups, difference significant if $P < .05$

intake and used analgesics and 3.3% (n = 24) first increased fluid intake and used cranberry, vitamin C or d-mannose before consulting a GP. Only 17.8% (n = 128) of the study population received a prescription for self-initiated antibiotic treatment. Of these women, 52.3% (n = 67) received this prescription on request before going on holiday. Table 2 shows reported preventive measures and use of nonprescription drugs. Complete bladder emptying was reported by 67.6% (n = 486) of all women, of whom 42.2% were familiar with one of four complementary options (urinating for a long time, relaxation of the bladder, sitting up straight with feet on the ground and tilting the pelvis when urinating stops).

3.4 | Source of information

Of all women, 39.9% (n = 287) searched the internet for information on self-management of UTI, whereas 8.8% (n = 63) looked for information in magazines. The proportion of women seeking information on the internet was significantly higher for the younger group of women, 18-51 years, with 57.3% compared to 30.0% in older women ($P < .001$). However, proportions for looking up information in magazines were significantly higher for women 51 years and older, with 10.9% compared to 5.0% in younger women ($P < .05$). Friends and family provided information to 28.8% (n = 207) of the women, a GP to 55.9% (n = 402), a pharmacist to 23.8% (n = 171) and a medical specialist to 5.4% (n = 39).

4 | DISCUSSION

4.1 | Summary

Half of all women applied self-management for an episode of recurring UTI before consulting a GP. Awareness of different preventive behavioural measures for recurring UTI varied between 20% and 90%.

4.2 | Strengths and limitations

A strength of this study is that we obtained a large number of questionnaires and medication records from women 18 years and older. Another strength is that the survey was anonymous, which may have stimulated women to give candid answers. Most women filled in the questionnaire online. By providing a choice between filling in the questionnaire online or completing it on paper in the pharmacy, women with limited digital skills could also be included. Nonetheless, women who were not proficient in Dutch were excluded.

However, it is still possible that women with a low literacy level refused to cooperate when asked. Since we only asked for education levels in the questionnaire, we have no record of literacy levels of women who refused to cooperate. Thus, our study may be less representative of this group. On the other hand, this effect may be limited for the older age group as primary, secondary and higher education levels in this group were comparable to national data for women 55 years and older in 2018 with 52%, 30% and 18%, respectively.[24] Primary, secondary and higher education levels for the younger age group with 36%, 36% and 28%, respectively, differed from the national levels for women 15-55 years with 25%, 34% and 40%, respectively. Thus, the overall education level of the age group 18-50 years was lower than the overall national education level. Since most of the results of the younger and older age groups were comparable, this difference does not seem to have influenced the results.

According to the 2013 GP guideline, we asked women about ample fluid intake. A weakness is that we did not ask about the precise quantity of fluid intake.

TABLE 2 Preventive measures taken by adult women to prevent recurring UTI

	All women	Women 18-50 years	Women ≥51 years	
	N = 719	N = 262	N = 457	*P*-value
Behavioural measures				
Ample fluid intake	88.0% (633)	89.7% (235)	87.1% (398)	
Complete emptying of the bladder	67.6% (486)	65.6% (172)	68.7% (314)	
Urinating for a long time	33.9% (248)	34.7% (91)	33.9% (155)	
Relaxation of the bladder	22.3% (163)	26.7% (70)	19.9% (91)	
Sitting up straight, feet on the ground	33.5% (245)	31.7% (83)	34.8% (159)	
Tilting the pelvis when urinating stops	26.3% (192)	26.7% (70)	25.6% (117)	
Not postponing micturition	64.4% (463)	65.6% (172)	63.7% (291)	
Emptying bladder soon after sexual intercourse	45.9% (330)	74.4% (195)*	29.5% (135)*	<.001
Washing without (alkaline) soap	53.7% (386)	55.3% (145)	52.7% (241)	
Wiping buttocks from front to back	61.9% (445)	65.6% (172)	59.7% (273)	
Nonprescription drugs				
Cranberry capsules	33.9% (244)	29.8% (78)*	36.1% (165)*	<.05
Cranberry drink	18.1% (130)	18.7% (49)	17.7% (81)	
D-mannose	4.6% (33)	5.0% (13)	4.4% (20)	
Vitamin C	29.1% (209)	28.6% (75)	29.3% (134)	

Note: Abbreviation: UTI, urinary tract infections.

*Statistical significance tested by chi-square test, difference significant if $P < 0.05$.

4.3 | Comparison with existing literature

The use of analgesics was mentioned by 15% of women. This proportion is higher than reported in an earlier study in GP practises which found that, in the Netherlands, despite GP guideline recommendations, analgesic prescriptions or advice to buy analgesics without prescription were negligible.[25] This study only analysed the use of analgesics prescribed or advised by a GP in a consultation, whereas we asked women whether they used an analgesic before consulting a GP.

Emptying the bladder soon after sexual intercourse seems better known to younger women, which may be the result of less sexual intercourse in older women. On the other hand, as with younger women, a study showed that recent sexual intercourse is strongly associated with incidental UTI in generally healthy postmenopausal women.[26] Thus, our finding may also be caused by less knowledge of older women who consulted the internet less frequently or by a lack of articles about sexual topics in magazines.

Cranberry was used by almost 50% of the study population, which seems relatively high, considering the limited evidence, but data on the extent of use have not been previously reported. Almost 20% of women reported the use of cranberry juice. As the acceptability of the taste of pure cranberry juice is low, it is likely that most women use cranberry beverages with a limited amount of cranberry.[16] D-mannose was self-reported by a very low proportion of women and was not mentioned in the 2013 GP guideline. However, nowadays d-mannose is mentioned in the revised UTI guideline,[15] which might increase the use of d-mannose in coming years. Vitamin C was used by almost one third of women. This proportion seems rather high, considering the limited evidence for the effectiveness of vitamin C and the risk of urolithiasis in doses of 500-2000 mg/day.[27]

4.4 | Implications for research and/or practise

Considering that three-quarters of women felt pain or burning when passing urine, women should be actively questioned about their actions taken before consulting a GP and informed about the use of analgesics. This intervention might increase their willingness to apply self-management.

Over 90% of women recognised a recurring UTI episode, whereas almost 50% of them recognised it based on the three primary symptoms. Of the women with a medication record that recognised UTI based on these three symptoms, approximately 50% had one or two episodes in the preceding 12 months. This finding also shows that even women with a limited number of episodes may be able to recognise a UTI episode.

The proportion of women that reported a prescription for self-initiated treatment in previous years was 18%, and almost half of them received it for as needed use during a holiday. Considering that almost 50% of women recognised an episode of UTI based on three symptoms, they might qualify for self-initiated treatment,[28] provided they use it appropriately and recognise differential and alarm symptoms. This possibility should be discussed with women who are eligible for self-initiated treatment.

Of the behavioural preventive measures, ample fluid intake was reported most frequently; nevertheless, only 50% reported increasing fluid intake before consulting a GP. Moreover, since "ample" is subject to personal interpretation, fluid intake should be quantified. Women with recurring UTI can be advised to drink more fluids with individualized volume based on a patient's specific circumstance.[29,30] The revised 2019 GP guideline recommends an increase of fluid intake up to 3 L per day, accounting for comorbidities such as heart failure.[15]

Over 60% of women reported complete emptying of the bladder. However, when questioned about how this emptying was achieved, 40% of these women were familiar with only one of four complementary options (urinating for a long time, relaxation of the bladder, sitting up straight with feet on the ground and tilting the pelvis when urinating stops). The other behavioural measures (no postponing of micturition, washing without soap, emptying bladder soon after sexual intercourse and wiping front to back) were self-reported by 45%-70% of women. These results show ample room for improvement and should be discussed in consultations with women.[31]

The Dutch 2019 GP guideline recommends evaluating the use of cranberry or d-mannose after several months but within the span of one year.[15] However, as these are nonprescription drugs, health care providers should question women actively about use not only of cranberry and d-mannose but also of vitamin C.

More than 50% of women 18-50 years found information on the internet. As this proportion will probably increase in forthcoming years, it is crucial for health care providers to discuss with women their information sources and to recommend reliable sources of information. Health care providers should discuss with women with recurring UTI practical ways to prevent and self-manage an episode, advising them on how to improve outcomes that decrease the number of antibiotics prescribed for recurring UTI.

5 | CONCLUSION

This study shows that almost 50% of women already used some form of self-management before consulting a GP. The majority of women had limited awareness of the risk factors and self-administered prevention of UTI. Hence, health care providers should pay more attention to educating women with recurring UTI about nonantibiotic prevention.

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DISCLOSURES

The authors have no competing interests.

AUTHOR CONTRIBUTIONS

Rian Lelie van der Zande: Methodology, Conceptualization, Formal analysis, Writing-original draft and Writing-review & editing. Ellen S. Koster: Writing-review & editing. Martina Teichert: Methodology and Writing-review & editing. Marcel L. Bouvy: Methodology and Writing-review & editing.

ETHICAL APPROVAL

This study was submitted to the Medical Ethical Review Board of Utrecht Academic Hospital, which confirmed that no ethical approval was required as the study was not subject to the Medical Research Involving Human Subjects Act (WMO).

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Rian Lelie-van der Zande https://orcid.org/0000-0001-5749-5700

REFERENCES

1. Butler CC, Hawking MKD, Quigley A, McNulty CAM. Incidence, severity, help seeking, and management of uncomplicated urinary tract infection: a population-based survey. *Br J Gen Prac*. 2015;65(639):e702–e707. https://doi.org/10.3399/bjgp15x686965
2. Foxman B. Epidemiology of urinary tract infections: incidence, morbidity, and economic costs. *Am J Med*. 2002;113:5S-13S.
3. Foxman B, Barlow R, D'Arcy H, Gillespie B, Sobel JD. Urinary tract infection. *Ann Epidemiol*. 2000;10(8):509–515. https://doi.org/10.1016/s1047-2797(00)00072-7
4. Gupta K, Trautner BW. Diagnosis and management of recurrent urinary tract infections in non-pregnant women. *BMJ*. 2013;346(4):f3140–f3140. https://doi.org/10.1136/bmj.f3140
5. Nivel. Percentage patiënten dat antibioticum krijgt voorgeschreven daalt iets. 2018. Available from: https://www.nivel.nl/nl/nieuws/percentage-patienten-dat-antibioticum-krijgt-voorgeschreven-daalt-iets
6. Pietrucha-Dilanchian P, Hooton TM. Diagnosis, treatment, and prevention of urinary tract infection. *Microbiol Spectrum*. 2016;4(6). https://doi.org/10.1128/microbiolspec.uti-0021-2015
7. Bonkat G, Bartoletti RR, Bruyère F, Cai T, Geerlings SE, Köves B, et al. EAU Guidelines on Urological Infections Arnhem. The Netherlands: EAU Guidelines Office; 2019 [cited 2020 16 April]. Available from: https://uroweb.org/wp-content/uploads/EAU-Guidelines-on-Urological-infections-2019.pdf
8. Chu CM, Lowder JL. Diagnosis and treatment of urinary tract infections across age groups. *Am J Obstetrics Gynecol*. 2018;219(1):40–51. https://doi.org/10.1016/j.ajog.2017.12.231
9. Knottnerus BJ, Geerlings SE, Moll van Charante EP, ter Riet G. Women with symptoms of uncomplicated urinary tract infection are often willing to delay antibiotic treatment: a prospective cohort study. *BMC Family Pract*. 2013;14(1). https://doi.org/10.1186/1471-2296-14-71
10. Al Demour S, Ababneh MA. Evaluation of behavioral and susceptibility patterns in premenopausal women with recurrent urinary tract infections: a case control study. *Urol Internat*. 2018;100(1):31–36. https://doi.org/10.1159/000485568
11. Abdelaziz AS, Badran YA, El-Kashef TA, Ali MM. Impact of genital hygiene and sexual activity on urinary tract infection during

pregnancy. *Urol Ann*. 2015;7(4):478. https://doi.org/10.4103/0974-7796.157971
12. Wan X, Wu C, Xu D, Huang L, Wang K. Toileting behaviours and lower urinary tract symptoms among female nurses: a cross-sectional questionnaire survey. *Int J Nurs Stud*. 2017;65 1–7. https://doi.org/10.1016/j.ijnurstu.2016.10.005
13. Zhu M, Wang S, Zhu Y, et al. Behavioral and dietary risk factors of recurrent urinary tract infection in Chinese postmenopausal women: a case–control study. *J Int Med Res*. 2020;48(3):030006051988944. https://doi.org/10.1177/0300060519889448
14. Van Pinxteren B, Knottnerus B, Geerlings S, et al. NHG-standaard urineweginfecties(derde herziening). *Huisarts Wet*. 2013;56(6):270-280.
15. Bouma M, Geerlings SE, Klinkhamer S, et al. NHG-standaard Urineweginfecties Utrecht: NHG; 2019 [cited 2020 28 April]. Available from: https://richtlijnen.nhg.org/standaarden/urineweginfecties#volledige-tekst-indeling-urineweginfecties
16. Jepson RG, Williams G, Craig JC. Cranberries for preventing urinary tract infections. *Cochrane Database Syst Rev*. 2012. https://doi.org/10.1002/14651858.cd001321.pub5
17. Domenici L, Monti M, Bracchi C, et al. D-mannose: a promising support for acute urinary tract infections in women. A pilot study. *Eur Rev Med Pharmacol Sci*. 2016;20(13):2920-2925. PMID: 27424995.
18. Kranjčec B, Papeš D, Altarac S. d-mannose powder for prophylaxis of recurrent urinary tract infections in women: a randomized clinical trial. *World J Urol*. 2014;32(1):79–84. https://doi.org/10.1007/s00345-013-1091-6
19. Miranne JM. Recurrent urinary tract infection in women. *Curr Obstet Gynecol Rep*. 2017;6(4):282–289. https://doi.org/10.1007/s13669-017-0228-9
20. Beerepoot M, Geerlings S. Non-antibiotic prophylaxis for urinary tract infections. *Pathogens*. 2016;5(2):36. https://doi.org/10.3390/pathogens5020036
21. Vahlensieck W, Perepanova T, Bjerklund Johansen TE, Tenke P, Naber KG, Wagenlehner FME. Management of uncomplicated recurrent urinary tract infections. *Eur Urol Suppl*. 2016;15(4):95–101. https://doi.org/10.1016/j.eursup.2016.04.007
22. Aslam S, Albo M, Brubaker L. Recurrent urinary tract infections in adult women. *JAMA*. 2020;323(7):658. https://doi.org/10.1001/jama.2019.21377
23. Smith AL, Brown J, Wyman JF, Berry A, Newman DK, Stapleton AE. Treatment and prevention of recurrent lower urinary tract infections in women: a rapid review with practice recommendations. *J Urol*. 2018;200(6):1174–1191. https://doi.org/10.1016/j.juro.2018.04.088
24. CBS. Statline: CBS; 2020 [cited 2020 26 November]. Available from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/37296NED/table?fromstatwe
25. Butler CC, Francis N, Thomas-Jones E, et al. Variations in presentation, management, and patient outcomes of urinary tract infection: a prospective four-country primary care observational cohort study. *Br J Gen Prac*. 2017;67(665):e830–e841. https://doi.org/10.3399/bjgp17x693641
26. Moore EE, Hawes SE, Scholes D, Boyko EJ, Hughes JP, Fihn SD. Sexual intercourse and risk of symptomatic urinary tract infection in post-menopausal women. *J Gen Int Med*. 2008;23(5):595–599. https://doi.org/10.1007/s11606-008-0535-y
27. Noureldin YA, da Silva A, Fahmy N, Andonian S. Is it safe to prescribe ascorbic acid for urinary acidification in stone-forming patients with alkaline urine?. *Türk Üroloji Dergisi/Turk J Urol*. 2017;43(2):183–188. https://doi.org/10.5152/tud.2017.02700
28. Gupta K, Hooton TM, Stamm WE. Increasing antimicrobial resistance and the management of uncomplicated community-acquired urinary tract infections. *Ann Int Med*. 2001;135(1):41. https://doi.org/10.7326/0003-4819-135-1-200107030-00012
29. Hooton TM, Vecchio M, Iroz A, Tack I, Dornic Q, Seksek I, Lotan Y. Effect of increased daily water intake in premenopausal women with recurrent urinary tract infections. *JAMA Int Med*. 2018;178(11):1509. https://doi.org/10.1001/jamainternmed.2018.4204
30. Scott AM, Clark J, Mar CD, Glasziou P. Increased fluid intake to prevent urinary tract infections: systematic review and meta-analysis. *Br J Gen Prac*. 2020;70(692):e200–e207. https://doi.org/10.3399/bjgp20x708125
31. Lecky DM, Howdle J, Butler CC, McNulty CAM. Optimising management of UTIs in primary care: a qualitative study of patient and GP perspectives to inform the development of an evidence-based, shared decision-making resource. *Br J Gen Prac*. 2020;70(694):e330–e338. https://doi.org/10.3399/bjgp20x708173

SUPPORTING INFORMATION

Additional Supporting Information may be found online in the Supporting Information section.

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