

# Urinary Tract Infection (UTI) Program

## Evidence to Support Discontinuing the Use of Dipsticks to Diagnose a UTI in Residents of Long-Term Care Homes (LTCHs)

Change is not possible without first getting buy-in for the practice changes. This resource reviews the literature on the use of dipsticks in this population. It supports one of the five practice changes: to avoid using dipsticks to diagnose UTIs in residents of LTCHs.

This resource is part of Public Health Ontario's [UTI Program](#). For more information, please visit [publichealthontario.ca/UTI](http://publichealthontario.ca/UTI) or email [UTI@oahpp.ca](mailto:UTI@oahpp.ca).

**The use of dipsticks as a screening tool in suspected UTIs in the elderly is NOT recommended. An extensive literature review has led to the following conclusions:**

- Dipstick tests with negative results for both nitrites and leukocyte esterase have a high negative predictive value and can be used to *rule out* a UTI.
- Dipstick tests cannot be used to diagnose a UTI. A dipstick test that is positive for nitrites, leukocyte esterase or both is not predictive of infection. The presence of clinical symptoms of a UTI and a positive culture and susceptibility test are required for a UTI diagnosis.

## Background

*Current practice using dipsticks to screen for and diagnose UTIs in LTCHs from a 2013 Ontario survey*

Infection control professionals and health care providers involved in the prevention, diagnosis and/or treatment of UTIs in Ontario long-term care homes (LTCHs) were invited to take part in an online survey to investigate current practices related to using dipsticks for UTI diagnosis. The survey was administered between February 28 and March 15, 2013. There were 453 responses to the survey; 72 were excluded due to incompleteness, leaving 381 responses for inclusion in analysis.

Overall, 40% to 45% of survey respondents indicated that they would take a positive dipstick result into consideration when deciding whether or not to send a urine specimen for culture and susceptibility.<sup>a</sup> Only three respondents indicated that they would use dipsticks to screen for a UTI in residents without typical UTI symptoms of dysuria, fever, new flank or suprapubic pain, urinary incontinence or increased

frequency/urgency. Another three respondents indicated that they would use dipsticks to diagnose UTI and start antibiotic treatment based on positive dipstick results when they anticipated delays in receiving laboratory results or when they encountered challenges in assessing residents with dementia and incontinence. Uncertainties around using dipsticks to screen for and diagnose UTIs were also observed; respondents indicated that they would like to have educational resources on indications for urine dipsticks.<sup>b</sup>

## Literature Review

### *Use of nitrite and leukocyte esterase dipsticks for screening and diagnosing UTIs in the elderly in LTCHs*

In October 2012, the Regional Infection Control Networks of Public Health Ontario conducted a review of published and grey literature from 1997 to 2012 on urinary dipsticks and UTIs in LTCHs.<sup>c</sup> Various authors reported wide variations in the sensitivity, specificity and predictive value of dipstick results, but evidence specifically about elderly residents of LTCHs was scarce. Articles identified in the literature review are summarized below.

- The European urinalysis guidelines listed a range of factors that may contribute to false positive and false negative results when using leukocyte esterase and nitrite dipsticks.<sup>1, d</sup>
- Majid and Buba found that a positive nitrite test significantly predicted Gram-negative organisms as the likely causative agent of a UTI (positive predictive value, 95.4%);<sup>2</sup> however, in view of the low sensitivity of urine nitrite across all groups of organisms (5.5% for Gram-positive organisms and 49.7% for Gram-negative organisms), the dipstick test was determined to be unsuitable as a screening tool. Majid and Buba's findings were based on a retrospective review of 416 medical records in patients 13 years of age and older at a hospital in Saudi Arabia. The authors did not report how urine specimens were collected and handled and they did not define compatible symptoms for inclusion. Findings may not be generalizable to elderly residents of Ontario LTCHs.
- Little, Turner and Rumsby found that dipstick results could modestly improve diagnostic precision in lower UTIs if they were positive for nitrites and blood or leukocyte esterase (positive predictive value, 92%), but if they were negative for all three, they were poor at ruling out infection (negative predictive value, 76%).<sup>3</sup> The authors suggested that clinicians would need to use appropriate strategies, such as delayed prescription to take the relatively low negative predictive value into account. This study's findings were based on a prospective assessment of 434 adult female patients (ages 18 to 70) who presented to general practice offices in England with a suspected lower UTI. Bacteriuria was assessed using the European urinalysis guidelines.<sup>1</sup> Findings may not be generalizable to elderly residents of Ontario LTCHs.
- St John, Boyd, Lowes and Price found evidence supporting the use of a nitrite or leukocyte esterase combination to rule out UTIs in certain circumstances, especially when there was a low- to mid-range prevalence of UTIs;<sup>4</sup> however, the authors compared their results with those of other systematic reviews and found considerable heterogeneity in the accuracy of dipstick testing for a variety of reasons. This review was based on 14 studies from 1966 to 2003, using a cutoff of 10<sup>8</sup> CFU/L and a leukocyte esterase or nitrite test combination with a positive result on one test or the other. None of the 14 studies focused on elderly residents of LTCHs.

- Sundvall and Gunnarsson found that when both nitrite and leukocyte esterase dipsticks were negative, the presence of potentially pathogenic bacteria (*Escherichia coli*, *Enterococcus faecalis*, *Klebsiella* species) in the subsequent urine culture could be ruled out with a high negative predictive value of 88%;<sup>5</sup> however, a positive result on either or both dipsticks could not completely rule in the presence of bacteriuria. This study focused on elderly residents of nursing homes. While the authors stated that the results could be generalizable in developed countries to evaluate urine dipstick analysis for elderly individuals at nursing homes performed in ordinary clinical practice, they used criteria from the European urinalysis guidelines<sup>1</sup> for a positive culture. The negative predictive value of dipsticks may be different if criteria from Canadian urinalysis guidelines are applied. This study also included asymptomatic subjects; the predictive value of dipsticks in symptomatic LTCH populations may be different.
- Genao and Buhr found that a urine specimen with bacteriuria and pyuria in LTCH residents was insufficient to confirm a diagnosis of clinically suspected UTI.<sup>6</sup> Both conditions will be present in approximately half of patients without a urinary catheter and in almost all patients with an indwelling catheter. The authors found that dipstick testing for urine was a quick way to rule out UTI as the cause of the residents' symptoms. They quoted Juthani and Mehta's study, which demonstrated a negative predictive value of 100%, but a positive predictive value of 45%; a positive leukocyte esterase and/or nitrite result was not synonymous with infection, but if both results were negative, clinician could be certain that there was no UTI.<sup>7</sup> The authors did not describe what literature was included in their review, making it a challenge to generalize their findings.
- The Society of Healthcare Epidemiologists of America stated that the leukocyte esterase test was a dipstick method for identifying pyuria and, in elderly institutionalized populations, has been shown to have a broad positive predictive value of 18% to 75% for infection and a negative predictive value of 75% to 100%.<sup>8</sup> The presence or absence of pyuria in a urinalysis specimen should not be used as a criterion for diagnosing UTI or to differentiate symptomatic from asymptomatic infection.

## Footnotes

- <sup>a</sup> For residents with an indwelling urinary catheter, 151 of the 381 (39.6%) respondents reported including a positive nitrite dipstick result and 156 (40.9%) respondents reported including a positive leukocyte esterase dipstick result when deciding to send a urine specimen for culture and susceptibility. For residents without an indwelling urinary catheter, 171 (44.9%) reported including a positive nitrite dipstick result and 170 (44.6%) reported including a positive leukocyte esterase dipstick result when deciding to send a urine specimen for culture and sensitivity.
- <sup>b</sup> The number of respondents expressing a preference for resources on the indications for urine dipstick are as follows: 148 of the 381 respondents (38.8%) chose a fact sheet or brochure; 103 (27.0%) chose a toolkit; 88 (23.1%) chose a flowchart or algorithm; 71 (18.6%) chose narrated presentations or scenarios; and 61 (16.0%) chose an audit tool or checklist.
- Embase and MEDLINE databases were used in the literature review, using the following keywords: adult, aged, aged hospital patient, aging, antibiotic, anti-infective, antimicrobial, asymptomatic bacteriuria prevent, avert, avoid, bacteriuria, care, catheter-related urinary tract infections, classification, clean catch, collect, criteria, definition, diagnosis, disease management, drug, drug prescription, drug resistance, drug therapy, drug utilization, elder, elderly, elderly care, epidemiology, frail elderly, geriatric, geriatric assessment, gerontologic care, handle, health services for the aged, home for the aged, hospice care, hospitalized aged, housing for the elderly, inappropriate prescribing, incidence, infection prevention, institutionalize, long-term care, manage, men, microbial drug resistance, middle age, morbidity, nurses, nursing assessment, nursing diagnosis, nursing home, nursing home patients, nursing process, nursing staff, nutrition therapy, older, palliative care, patient care, population surveillance, prescribing patterns, prescription, prevalence, prevent, preventive health care, preventive health service, preventive medicine, process assessment, prophylactic, pyuria, rehabilitation patients, residential facilities, residential home, resist, respite care, retirement home, specimen, specimen handling, standards, statistics, stewardship, therapy, treat, urinary tract infection, urine specimen collection, UTI prevent, very elderly, women. Articles that dealt with UTIs solely in children, babies, infants, adolescents, pregnant women, young adults, premenopausal women and adults under the age of 65 were excluded. Articles from North America, United Kingdom, Western Europe, Australia and New Zealand were included. General accounts of drug resistance in UTIs from other regions were also included, but articles that focused on the management of UTI in developing or poorly resourced countries were excluded.
- <sup>d</sup> Leukocyte esterase dipsticks detect leukocytes on the basis of indoxyl esterase activity released from lysed neutrophil and macrophages on the test pad.<sup>1</sup> Results may be falsely positive with coloured urine (beet ingestion, bilirubinuria), sodium azide, oxidizing detergents and formaldehyde (0.4 g/L). Results may also be falsely negative with vitamin C (intake g/day), protein > 5 g/L, glucose > 20 g/L, mucous specimen, cephalosporins, nitrofurantoin, mercuric salts, trypsin inhibitor, oxalate and 1% boric acid. Nitrite dipsticks detect bacteria based on activity of the nitrate reductase present in most Gram-negative uropathogenic bacilli, such as *Escherichia coli*; however, nitrate reductase is lacking from some common uropathogens (e.g., *Enterococcus* species and *Staphylococcus* species). Results may be falsely positive with coloured urine or *in vitro* growth. Results may also be falsely negative when there are no vegetables in diet, when bladder incubation time is short, with Gram-positive bacteria and with vitamin C.

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## Citation

Ontario Agency for Health Protection and Promotion (Public Health Ontario). Urinary tract infection (UTI) program: evidence to support discontinuing the use of dipsticks to diagnose a UTI in residents of long-term care homes (LTCHS). Toronto, ON: Queen's Printer for Ontario; 2019.

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## Publication History

**Published:** August 2016

**1<sup>st</sup> Revision:** November 2019

Public Health Ontario acknowledges the financial support of the Ontario Government.

