CLINICAL PERFORMANCE OF THE PA-100 POINT-OF-CARE AST DEVICE IN AMBULATORY CARE

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Abstract

Context Urineweginfecties (UWI's) behoren tot de meest voorkomende bacteriële infecties in de eerstelijnszorg en dragen in belangrijke mate bij aan antibioticavoorschriften en antimicrobiële resistentie (AMR). Door de tijdsvertraging van klassieke laboratoriumdiagnostiek wordt vaak empirisch behandeld. Snelle point-of-care (POC) diagnostiek, zoals het PA-100 Antimicrobial Susceptibility Testing (AST) systeem, kan bijdragen aan meer gerichte therapie.

Onderzoeksvraag Deze studie had tot doel te evalueren of het PA-100 AST point-of-care toestel vergelijkbare diagnostische prestaties levert als de standaard laboratoriummethode voor de detectie van bacteriurie en het bepalen van antibioticagevoeligheid in een ambulante setting. Eveneens werd de gebruiksvriendelijkheid van het PA-100 AST toestel geëvalueerd.

Methode Er werd een prospectieve, niet-geblindeerde cohortstudie met gepaarde analyse uitgevoerd in huisartspraktijken en urologische settings. Urinestalen van volwassen patiënten met vermoeden van een UWI werden zowel met het PA-100 toestel als met de referentielaboratoriummethode geanalyseerd. Diagnostische performantie werd geëvalueerd aan de hand van sensitiviteit, specificiteit, predictieve waarden en categorische overeenkomst. De McNemar-test werd gebruikt om systematische verschillen tussen beide methoden te onderzoeken. Gebruiksvriendelijkheid werd beoordeeld met de System Usability Scale (SUS). Missing data werden verwerkt via complete case analyse.

Resultaten In totaal werden 89 urinestalen geïncludeerd in de analyse. Het PA-100 toestel behaalde een sensitiviteit van 80,95% (95% BI: 58,1 - 94,6%) en een specificiteit van 89,71% (95% BI: 79,9 - 95,8%). De totale categorische overeenkomst bedroeg 87,6%. De positief predictieve waarde was 70,8%, terwijl de negatief predictieve waarde 93,8% bedroeg, wat aangeeft dat het toestel beter geschikt is om bacteriurie uit te sluiten dan te bevestigen. Er werd geen statistisch significant verschil gevonden tussen beide methoden (McNemar $p = 0,548$). Voor antibioticagevoeligheid werd een categorische overeenkomst van 80,6% vastgesteld. De gemiddelde SUS-score bedroeg 77,86, wat wijst op een bovengemiddelde gebruiksvriendelijkheid.

Conclusie Het PA-100 AST-systeem toont een goede diagnostische performantie en gebruiksvriendelijkheid in een ambulante setting, met resultaten die grotendeels vergelijkbaar zijn met standaard laboratoriumdiagnostiek. De snelle doorlooptijd en hoge negatief predictieve waarde maken het toestel veelbelovend voor het uitsluiten van bacteriurie en het ondersteunen van antibioticabeleid. De aanwezigheid van vals-positieve resultaten, de beperkte steekproefgrootte en het ontbreken van follow-upgegevens benadrukken echter de nood aan verder grootschalig onderzoek om de klinische impact te bevestigen.

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List of abbreviations

UTI	Urinary tract infection
GP	General practitioner
STI	Sexually transmitted infection
AST	Antimicrobial/antibiotic susceptibility testing
AMR	Antimicrobial resistance
POC(T)	point-of-care (test)
SUS	System Usability Scale

1. Introduction

1.1 Background

Urinary tract infections (UTIs) are among the most common bacterial infections and represent a major driver of antibiotic prescribing in primary care. Data from the Intego general practice registry in Flanders (Belgium) show an increase in UTI incidence over recent decades [1]. In 2024, a prevalence of 29,27 per 1000 patients was registered by Flemish doctors, whereas in 2000 it was only 12,71 per 1000 patients. This increase may partly reflect improved detection and registration in general practice. Nevertheless, the trend underlines the continuing clinical relevance of UTIs. According to Domus Medica, the professional association for general practitioners (GPs) in Flanders, painful urination, increased frequency of urination, and urinary urgency account for about 2-5% of the reasons women consult a general practitioner in Belgium [2]. The causative agents of UTIs are almost exclusively organisms originating from the fecal flora, like Escherichia coli (75-85% of cases) and Staphylococcus saprophyticus (10-15%). Rare pathogens include Klebsiella species, Enterobacter and Pseudomonas species [3].

In current practice, the diagnosis of UTIs is mainly based on clinical symptoms and only sometimes supported by laboratory urine analysis. According to the Domus Medica guidelines, cystitis can be diagnosed in women without further testing when they present with sudden severe dysuria, have no vaginal symptoms and no increased risk for sexually transmitted infections (STIs) [2]. The diagnosis can also be made if the patient recognizes the symptoms from a previous episode. If these criteria are not met but cystitis is still suspected, a urine dipstick test should be performed to check for nitrites and leukocyte esterase. According to this guideline, a routine urine culture with antimicrobial susceptibility testing (AST) is not necessary for uncomplicated cystitis in women. Similarly, according to the Dutch NHG guidelines, cystitis is confirmed when urinary tract-related symptoms are present, combined with a positive nitrite test or a positive sediment [4].

A urine culture with AST is only recommended after two episodes of failed treatments in healthy, non-pregnant women or when cystitis occurs in patients from a risk group with an increased likelihood of a complicated course with tissue invasion. These risk groups include all men, children <12 years and pregnant women, as well as patients with diabetes mellitus or immunocompromised status, patients with structural or functional abnormalities of the kidneys or urinary tract (e.g. severe renal impairment with eGFR <30 ml/min/1.73 m^2, polycystic kidney disease, nephrolithiasis, neurogenic bladder, voiding dysfunction, or known post-void residual), patients with neurological bladder dysfunction [4].

In women without an increased risk, nitrofurantoin is the first-line therapy for uncomplicated cystitis in women (300mg daily in three doses for 5 days). Fosfomycin (3g in one dose once) is an alternative for pregnant women as nitrofurantoin is contra-indicated during the last weeks of pregnancy. In other patients from risk groups, including men, the first-choice treatment is

nitrofurantoin (300mg daily in 3 doses for 7 days) with treatment adjusted based on the antibiogram results. In children under 12 years, all cases of UTI, except for a first cystitis episode in girls older than 5, referral is required to exclude underlying anatomical or functional abnormalities. As this study does not focus on children as a target group, this aspect will not be further addressed or elaborated upon. In cases of mild to moderate symptoms, a watchful waiting approach, with or without a delayed antibiotic prescription, could also be considered [5].

In 2022, Gadalla *et al*. performed a secondary analysis of observational data from the POETIC trial in which women with uncomplicated UTIs were investigated in primary care [6]. They compared time to recovery with or without antibiotic use and found that patients who were prescribed antibiotics recovered faster, with a median recovery time of 7 days compared to 9 days without antibiotic treatment. In the POETIC trial, the Flexicult™ system was used, which provides point-of-care information on the causative bacteria within 24 hours.

1.2 Medical need

Often, even when a urine sample is sent to the lab for culture determination, healthcare providers rely on empiric antibiotic prescriptions to avoid delays in treatment, as the lab-based results take about two days to return. While these empiric prescriptions may address immediate needs, they play a significant role in the growing problem of antimicrobial resistance (AMR) [7, 8]. AMR can be intrinsic or acquired and is driven in part by inappropriate antibiotic use [9]. As a result, these resistant strains can not only persist but grow and spread, due to a lack of competition from other strains. An example of this kind of 'superbug' is the Methicillin-resistant Staphylococcus aureus (MRSA) [10]. According to a recent World Health Organization (WHO) article, Escherichia coli, has gained resistance to fluoroquinolone antibiotics, making this treatment ineffective in more than half of patients in many countries in the European Region [11].

AMR often results from inappropriate use of antimicrobial agents, such as prescribing antibiotics for viral infections or extending treatment durations unnecessarily. In 2014, the WHO launched a global action plan aimed at raising awareness and optimizing antibiotic use. This report addressed once again the need for an improved and coordinated global effort, including wider sharing of surveillance data for public health actions [12, 13]. If these actions are not taken, AMR will lead to infections that are harder to treat, causing prolonged illnesses, more complications, and higher mortality rates. A study commissioned by former British Prime Minister Dave Cameron predicted more deaths from AMR infections than from cancer by 2050 [10].

Besides the enormous consequences in terms of global health, the growing AMR problem will also burden the global economy immensely as healthcare systems will be faced with increased treatment costs and longer hospital stays. The same study predicted a cumulative cost to global economic output of 100 trillion USD by 2050 [12, 13]. According to OECD (Organisation for

Economic Co-operation and Development) estimates, the annual cost of AMR in Belgium is estimated at 24 million euros, but this cumulative cost could reach 787 million euros by 2050 [14]. To address this, , Belgium launched over the last years (2020 to 2024) a national One Health action plan for the fight against AMR, containing the actions of the different Belgian stakeholders in the pillars of human health, animal health and environmental health [15].

A 2024 review concluded that AMR contributes to an economic burden in community-acquired UTIs, affecting both patients and healthcare systems, as well as imposing societal costs. The review included 15 studies, with a majority coming from high-income countries, hospital settings, and focusing on infections caused by E. coli and K. pneumoniae. Overall, AMR was associated with a 1.50 odds ratio increase for mortality, explained by the higher risk of treatment failure and UTI complications, such as bacteremia and sepsis [16].

AMR is one of the greatest healthcare challenges we face today. While significant progress has been made in researching this issue, there is still much work to be done, and urgent action is needed to stay ahead of this growing threat.

1.3 Point-of-care diagnostics

One commonly suggested way of reducing the AMR rate is to promote new, rapid diagnostics like emerging point-of-care (POC) diagnostic technologies. They offer a promising solution to these challenges by providing on-site diagnostic data, hereby facilitating targeted antibiotic treatment decisions. A recent study aimed to determine whether POCTs for people with suspected UTIs have the potential to be clinically effective and cost-effective to the English National Health Service [17]. They found few available data, making it difficult to determine whether these tests have the potential to reach these objectives. A clear need for a rapid diagnostic test, that would ideally also provide information on antimicrobial sensitivity, was stated. The only test within their scope that meets these criteria is the PA-100 AST system.

The PA-100 AST System (by Sysmex) is an automated AST analyzer that leverages phase-contrast microscopy and nanofluidics to deliver antibiograms at the POC [18]. This system has been evaluated with the most common uropathogenic bacterial species in uncomplicated UTIs and simultaneously tests five commonly prescribed antibiotics (amoxicillin/clavulanic acid, ciprofloxacin, fosfomycin, nitrofurantoin, and trimethoprim) at various concentrations. During incubation, bacterial growth is monitored in real time using phase-contrast microscopy: resistant bacteria exhibit sustained growth, while susceptible bacteria show reduced growth or lysis. A software algorithm performs presumptive bacterial species identification and generates an antibiogram after assay completion. The POCT can directly analyze fresh urine samples with no pre-culturing or -treatment. Samples are pipetted directly into the PA-AST Panel U-0501, making the process suitable for near-patient settings. Targeted antibiotic treatment results are available in 45 minutes (Figure 1). The system is CE-marked and approved for medical use under the EU Medical Device Regulation (MDR) within the European Economic Area [18].

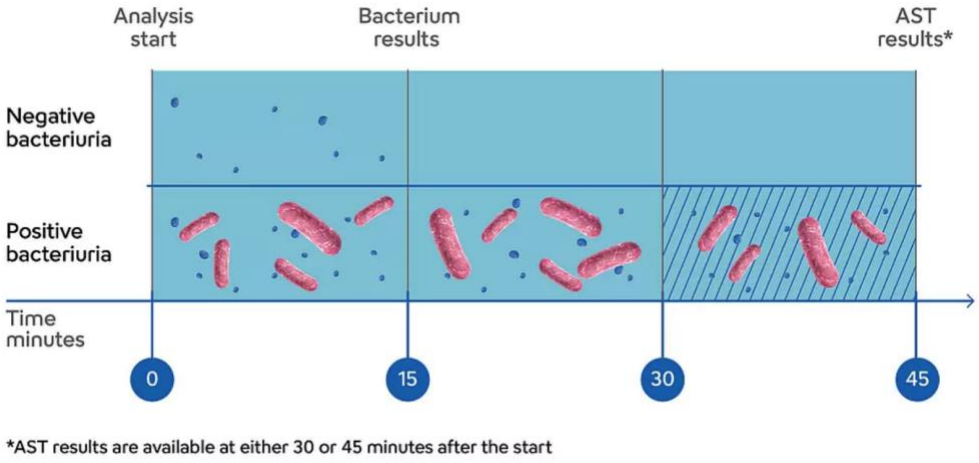


Figure 1: Timing of AST results [18]

The system is described to be user-friendly, requiring minimal hands-on time and microbiology expertise, aiming to be suitable for GP offices, emergency departments and other near-patient settings. This POCT could support GPs in making UTI diagnostic decisions and antibiotic selection, optimizing patient care, and reducing reliance on empiric prescriptions (Figure 2).

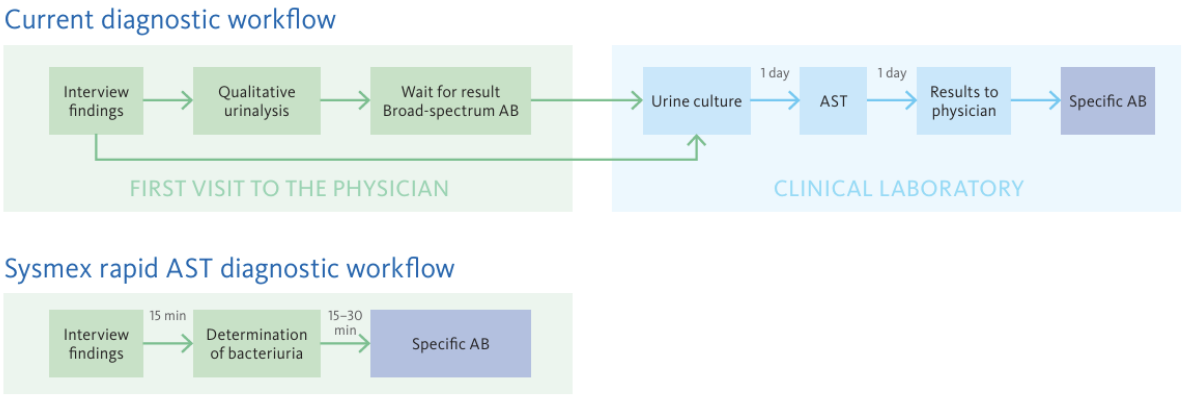


Figure 2: Workflow comparison between current standard practice and Sysmex POCT [19]

1.4 Aim of this study

The PA-100 AST System has previously demonstrated robust analytical performance, with an overall accuracy of 93.1% (89.1%- 95.9%) under instructions-for-use specifications. When evaluating all positive samples, regardless of species or bacterial count, the device achieved an accuracy of 82.0% (77.0%- 86.3%) [20].

The primary objective of this study is to evaluate the analytical performance of the PA-100 AST System in a real-world setting, specifically in ambulatory care environments such as GP practices or ambulatory urology clinics. By assessing the system's utility and effectiveness in routine care, we aim to provide insights into its impact on clinical decision-making and its potential role in combating AMR.

2. Materials & Methods

2.1 Literature review

This study was designed to evaluate the clinical performance and user friendliness of the PA-100 AST System. A structured literature search was first conducted to identify relevant methodological elements, which informed the development of the study protocol. To ensure a standardized and reproducible strategy, Medical Subject Headings (MeSH) were used.

The first search combined the MeSH terms “Urinary Tract Infections” (as major topic) and “Drug Resistance, Microbial.” All our queries were limited to articles published within the last five years and written in English. This search produced 17 results, of which 3 articles matched our subject after abstract screening. The second search combined the MeSH terms “Urinary Tract Infections” and “Point-of-Care Testing,” which yielded 19 results, and 3 of these articles were included after screening. In addition to the PubMed search, supplementary information was obtained through Sciensano, the Belgian national public health institute, Intego and Domus Medica [1, 2, 9, 21, 22]. Relevant reports and publications available on their platform were reviewed to gain an overview of the epidemiological situation of UTIs and AMR in Belgium and to ensure that the conclusions of this thesis reflected the current Belgian healthcare setting.

2.2 Study design

The investigation was conducted as a prospective, non-blinded cohort study with a paired design. This design allows for direct comparison between the POCT and the reference laboratory method using the same urine sample, thereby reflecting routine clinical practice and eliminating the need for a separate control group. The prospective nature of the study enables accurate assessment of diagnostic performance and minimizes recall bias.

The objectives of the study were to assess the diagnostic accuracy and user friendliness of the PA-100 AST System in patients presenting with a suspected uncomplicated UTI in an ambulatory care population. For the primary study endpoint sensitivity and specificity, defined as the ability of the device to correctly identify patients with and without a UTI, respectively, were compared to the reference standard (laboratory urine culture). Secondary endpoints included the agreement between the device-derived resistance profiles and those obtained by standard culture-based

susceptibility testing for the five antibiotics evaluated. Our exploratory endpoint was the user friendliness of the device, assessed through feedback from healthcare professionals.

Study procedures included participant recruitment, collection of symptoms and demographic qualities, execution of the POCT, laboratory analysis, documentation of results, and management of premature discontinuation when applicable. A concise technical description of the device was incorporated into the study protocol based on the manufacturer's instructions for use and clear online training modules. Safety reporting procedures were defined in the protocol and included the identification, documentation, and follow-up of any adverse events or device deficiencies occurring during the study. Reportable events were handled in accordance with applicable regulatory requirements and communicated to the responsible ethics committee as required.

The required sample size has been determined using a binomial proportion formula to achieve a margin of error of 7.5% for sensitivity and specificity at a 95% confidence level. Assuming an expected sensitivity and specificity of 84% and 99.4%, respectively, and accounting for a 25% prevalence of UTI and a drop-out rate of 10%, a total of 414 participants will be recruited.

2.3 Participant selection

Eligible participants were adults (≥18 years) presenting with symptoms suggestive of an uncomplicated UTI of less than seven days' duration, who had not received antibiotics in the five days preceding sample collection and were willing to provide a clean-catch midstream urine sample or a catheterized urine sample. Written informed consent was obtained from all participants prior to any study-related procedures. Patients with known anatomical abnormalities or renal disease (ICPC code U85), hospitalized patients, patients presenting to the emergency department, and individuals under 18 years of age were excluded. All screened participants were documented in the Investigator Site File.

The study was performed in both primary and secondary care settings, including the urology departments of AZ Diest and RZ Tienen, as well as two general practices located in Vosselaar, and Antwerp. Participating sites were responsible for patient inclusion and data collection, with a total target sample size of 414 patients.

2.4 Data collection and processing

All collected data was managed in accordance with applicable data protection regulations and ethical standards. The study was conducted in compliance with relevant ethical and regulatory requirements and received approval from the Ethics Committee of UZ/KU Leuven on July 30th of 2025 (reference number: S70064), as well as the local ethics committees of AZ Diest and RZ Tienen. After patient information and eligibility assessment, written informed consent was obtained and an identification log linking patient identity to the study code was completed. A

clinical examination and urine sampling, using a clean-catch midstream technique, were performed as part of usual care. Results of the PA-100 AST POCT were recorded in a paper-based case report form. Subsequently, the paper case report forms were entered into Castor EDC, an electronic data registration system, by the researchers

All clinical decisions were taken independently of the POCT result and followed standard care pathways. The result of the POCT could be used optionally as supportive information but was not mandatory for clinical decision-making. Patients were not required to remain in the practice while awaiting the POCT results. Electronic prescribing via national eID systems allowed prescriptions to be added or modified after the consultation if clinically indicated. Each participant was included during a single clinical consultation. Follow-up data were collected 30 days later through review of the electronic medical record.

The collected sample was used for two purposes: a small aliquot was analysed on site using the PA-100 AST System, while the remaining sample was sent to the microbiology laboratory for routine urine culture and conventional AST, which served as the reference method. No additional urine samples were required, and no long-term storage or biobanking was performed. Urine samples used for the POC analysis were required to be fresh, stored at room temperature, and analyzed within a maximum of 30 minutes after collection. No preservatives were used. The reference laboratory test consists of inoculating 1 μL of urine onto a Brilliance UTI agar medium. The inoculated plate is then incubated aerobically at 35°C for 24 hours, after which bacterial growth is evaluated. If present above the ≥50 000 colony-forming units (CFU)/ml cut off, bacteria are identified using MALDI-TOF mass spectrometry and AST is performed with the VITEK system. The information was obtained through personal telephone communications with CMA and AML laboratories.

2.5 Statistical analysis

For the evaluation of both the primary and secondary endpoints, a statistical analysis was performed using the collected study data. All data were initially recorded in Castor CDMS and subsequently exported to a Microsoft Excel dataset for further processing and analysis of numerical variables. The primary focus of the statistical analysis was to assess the diagnostic performance of the PA-100 device in comparison with the reference laboratory method. In this context, sensitivity and specificity were calculated as key outcome measures. Sensitivity was defined as the proportion of true positive samples correctly identified by the device among all samples classified as positive by the reference method. Specificity was defined as the proportion of true negative samples correctly identified among all samples classified as negative by the reference method.

In addition to these primary performance metrics, categorical agreement between the PA-100 and the laboratory method was evaluated. Categorical agreement was defined as the proportion of samples for which both methods yielded the same classification result (e.g., positive vs. negative

for bacteriuria, or identical susceptibility categorization for antibiotics). This measure provides an overall indication of concordance between both diagnostic approaches.

To further investigate potential systematic differences between the two methods, a McNemar's test was performed. This test is appropriate for paired nominal data and was used to assess whether there was a statistically significant difference in the proportion of discordant classifications (i.e., false positives versus false negatives). A p-value of less than 0.05 was considered statistically significant. Handling of missing data was performed using a complete case analysis (listwise deletion). In this approach, all samples with missing values in one or more variables relevant to the analysis were excluded. As a result, only cases with complete data across all variables of interest were included in the final statistical analysis.

2.6 AST by PA-100

As mentioned before, the PA-100 AST System is a CE-marked POC device intended for in vitro detection of bacteriuria, defined as the presence of actively growing bacteria at concentrations ≥50.000 CFU/mL. The device is designed for detection of Escherichia coli, Klebsiella pneumonia, Proteus mirabilis, Staphylococcus saprophyticus and Enterococcus faecalis. A negative bacteriuria result indicates the absence of actively growing bacteria above this threshold but does not exclude the presence of bacteria at lower concentrations. Antibiotic susceptibility is reported as susceptible (S), susceptible with increased exposure (I), resistant (R), or not applicable, in accordance with EUCAST clinical breakpoint standards.

The European Committee on Antimicrobial Susceptibility Testing (EUCAST) defines each susceptibility category by "breakpoints" specific for each species and agent [23]. These breakpoints are minimum inhibitory concentrations (MIC) that describe the amount of agent needed to inhibit the growth of bacteria and fungi. In 2019 and 2020 they changed the definition of "I, susceptible with increased exposure", now meaning that there is a high likelihood of therapeutic success when exposure to the agent is increased by adjusting the dosing regimen or by its concentration at the site of infection.

For analysis, the device was powered on and allowed to complete its self-test. Patient and operator identification were entered, and the barcode of the PA-AST test cartridge was scanned (Figure 4) [19]. A correctly filled pipette containing the urine sample, free of air bubbles and with appropriate excess volume, was used to fill the sample port of the cartridge, which was then sealed and inserted horizontally into the device. The analysis started automatically upon correct insertion.



Figure 4: PA-100 AST cartridge [19]

During the analysis, the urine sample passes through a filter into a nanofluidic chip. If bacterial cells are present, they become trapped within individual nanochannels. Other, larger components, like eukaryotic cells, are retained by the filter and therefore do not enter the nanofluidic chip. Following this step, Mueller Hinton Broth II flows through reservoirs containing dried antibiotics. The resulting growth medium is directed into the nanochannels where the bacterial cells are confined. All substances required for the analysis are preloaded within the cartridge. Incubation commences at this stage, while constant flow is maintained throughout the analysis via pressure regulation within the cartridge.

The nanofluidic chip contains approximately 11.000 nanochannels organized into 32 sections. Each section is exposed to a specific antibiotic at a defined concentration of antibiotics, which is used to determine the bacterial resistance profile. The cartridge is positioned so that it aligns the nanofluidic chip within the field of view of a phase-contrast microscope. Images of all 32 sections are captured at approximately one-minute intervals. A proprietary image analysis algorithm compiles the recorded images into time-lapse sequences and calculates the bacterial growth rate within each section. These growth rates are subsequently compared with those of a control section that is not exposed to antibiotics.

The turnaround time of the test is up to 30 minutes for bacteriuria-negative samples and up to 45 minutes for bacteriuria-positive samples with antibiotic susceptibility results. Device status and progress were indicated by color-coded LED signals. Test completion and error notifications were visually indicated and recorded. AST results were displayed together with possible warning symbols indicating technical uncertainty, proximity to clinical breakpoints, low bacterial growth, or technical errors. In cases of inconclusive or technically invalid results, the test could be repeated, or an alternative diagnostic method was recommended, in accordance with the manufacturer's instructions and EUCAST guidance.

2.7 User friendliness

Another exploratory endpoint is to assess the user-friendliness of this system, as it plays a crucial role in determining whether the POCT can be integrated into daily practice. To quantify this, we have chosen the System Usability Scale (SUS), a simple ten-item questionnaire that provides a comprehensive overview of subjective usability assessments [24].

In 2009, Lewis and Sauro suggested to use the word “awkward” rather than “cumbersome” in item 8 as research has shown that non-native English speakers often have troubles with the original wording [25, 26]. The alternation between positively and negatively worded statements in the standard SUS may potentially confuse respondents. However, research indicates that the results remain comparable, allowing for cross-study score comparisons [26]. Taking these considerations into account, we opted to use the original SUS by John Brooke, as it works for our intended use. However, given that the questionnaire will be filled out by non-native English speakers, we will change the word 'cumbersome' to 'awkward' in item 8, as suggested by Lewis and Sauro (Figure 3) [25].

To compute a SUS score, each of the 10 items is scored on a 1-5 scale (strongly disagree to strongly agree). For the odd-numbered items, 1 is subtracted from the selected rating. For the even-numbered items, the rating is subtracted from 5. All adjusted item scores are then added up and multiplied by 2.5 to obtain a final SUS score ranging from 0 to 100. An important note is that individual item scores are not meaningful on their own [24].

	The System Usability Scale Standard Version		**Strongly Disagree**				**Strongly Agree**
			1	**2**	**3**	**4**	**5**
1	I think that I would like to use this system frequently.		O	O	O	O	O
2	I found the system unnecessarily complex.		O	O	O	O	O
3	I thought the system was easy to use.		O	O	O	O	O
4	I think that I would need the support of a technical person to be able to use this system.		O	O	O	O	O
5	I found the various functions in this system were well integrated.		O	O	O	O	O
6	I thought there was too much inconsistency in this system.		O	O	O	O	O
7	I would imagine that most people would learn to use this system very quickly.		O	O	O	O	O
8	I found the system very awkward to use.		O	O	O	O	O
9	I felt very confident using the system.		O	O	O	O	O
10	I needed to learn a lot of things before I could get going with this system.		O	O	O	O	O

Figure 3: The system usability scale [25]

The Sauro-Lewis curved grading scale interprets SUS scores relative to a large dataset of usability studies [27]. In their scale, a score of about 68 corresponds roughly to the median, representing an average (C grade). The upper and lower 15% of scores map to A and F grades, respectively. In practice, a SUS score around 80 is often considered a strong benchmark. Table 1 shows the complete curved grading scale, showing the range of SUS scores for each grade and the corresponding percentile range.

SUS Score Range	Grade	Percentile Range
84.1 – 100	A+	96 – 100
80.8 – 84.0	A	90 – 95
78.9 – 80.7	A-	85 – 89
77.2 – 78.8	B+	80 – 84
74.1 – 77.1	B	70 – 79
72.6 – 74.0	B-	65 – 69
71.1 – 72.5	C+	60 – 64
65.0 – 71.0	C	41 – 59
62.7 – 64.9	C-	35 – 40
51.7 – 62.6	D	15 – 34
0.0 – 51.6	F	0 – 14

Table 1: The Sauro-Lewis curved grading scale [27]

3. Results

3.1 Study population

A total of 96 patients were enrolled between October 1st 2025 and March 31st 2026, including 45 men and 51 women (Table 2). Although not a strict exclusion criterion, no pregnant women were included. A total of 96 urine samples were initially collected for analysis. Of these, 6 samples were excluded because they did not meet the inclusion criteria, including 5 patients who had already received antibiotic treatment prior to sampling and 1 patient younger than 18 years. In addition, 1 sample was excluded based on an unspecified exclusion criterion. Four patients belonged to predefined risk groups, including two with neurogenic bladder dysfunction, one with diabetes mellitus, and one with a reduced immune status. Consequently, a total of 89 urine samples were included in the final analysis. Participants' ages ranged from 22 to 86 years old, with an average age of 54,9 years old (with 95% CI 51,1 - 58,7 years). All patient characteristics are summarized in Table 3. The initial target sample size of 414 was not reached, however, recruitment will continue after the completion this paper.

Study site	Patients enrolled
AZ Diest urology department	16
RZ Tienen urology department	42
GP practice Vosselaar	20
GP practice Antwerp	18

Table 2: Patient enrollment at participating study sites

Patient information	Final number of included samples	89
	Age (average & 95% CI) (years)	54,9 (51.1 - 58.7)
	Mean duration of symptoms (days)	3.55
	Median duration of symptoms (days)	3
Symptoms (n)	Dysuria / burning micturition	56
	Increased urinary frequency	38
	Hematuria	12
	Recognition of symptoms from previous episode	27
	Recent invasive procedure	3
	Urinary urgency	20
	Lower back or abdominal pain	10
	Signs of tissue invasion:	
	Fever	1
	Chills	5
	General discomfort	2
	Flank/perineal pain	2
	Delerium	0
	Sepsis	0
Clinical examination (n)	Abnormal abdominal examination	3
	Abnormal genital examination	1
Diagnoses	Cystitis (n,%)	33 (37.1%)
	Treated with medication (n)	21

	Sexually transmitted infection (STI) (n,%)	2 (2.2%)
	Incontinence (n,%)	2 (2.2%)
	Prostatitis (n,%)	2 (2.2%)
	No disease (n,%)	9 (10.1%)
	No diagnosis registration (n,%)	41 (46,1%)
Management	Watchful waiting / reassurance (n,%)	13 (14.6%)
	Initiate treatment:	30
	Nitrofurantion (n)	22
	Fosfomycin (n)	4
	Trimethoprim-suflamethoxazole (n)	1
	Levofloxacin/Ciprofloxacin (n)	2
	Mirabegron (n)	1
Follow-up	Complete resolution of symptoms (n, %)	21 (23.6%)
	Persistent symptoms (n, %)	5 (5.6%)
	No follow-up (n, %)	63 (70.8%)

Table 3: Overview of patient characteristics (n: number; CI: confidential interval)

3.2 Primary endpoints

According to the laboratory results, 21 samples were positive for bacteriuria (≥ 50,000 CFU/mL), while 68 samples were classified as negative. When comparing the PA-100 AST system to the reference method, 17 samples were correctly identified as positive (true positives), and 61 samples were correctly identified as negative (true negatives). In addition, 7 samples were classified as positive by the device despite being negative according to the laboratory (false positives), and 4 samples were missed by the device (false negatives).

		Standard laboratory test	
		Positive bacteriuria	Negative bacteriuria
PA-100 AST	Positive bacteriuria	17	7
	Negative bacteriuria	4	61

Table 4: 2×2 contingency table

Based on these findings, the sensitivity of the PA-100 was calculated at 80.95%, while the specificity reached 89.71% (Table 4). To further quantify diagnostic performance, 95% confidence intervals (CI) were calculated. The sensitivity of 80.95% corresponded to a 95% CI of approximately 58.1% to 94.6%, while the specificity of 89.71% corresponded to a 95% CI of approximately 79.9% to 95.8%.

Overall, the device demonstrated a high level of diagnostic accuracy. The total categorical agreement, defined as the proportion of correctly classified samples, was 87.6%. The positive predictive value (PPV) of the PA-100 was 70.8% with a 95% confidence interval of 48.9% to 87.4%, while the negative predictive value (NPV) was much higher at 93.8% with a 95% confidence interval of 84.8% to 98.3%.

In addition, a McNemar's test was performed to assess whether there was a statistically significant difference in the proportion of discordant pairs (false positives versus false negatives). The test did not show a statistically significant difference between both methods ($p = 0.548$).

3.3 Secondary endpoints

Other than bacteriuria detection, antibiotic susceptibility testing was performed for five commonly used antibiotics, namely amoxicillin/clavulanic acid (AMC), ciprofloxacin (CIP), fosfomycin (FOS), nitrofurantoin (NIT) and trimethoprim (TRI) (Table 5).

Reference test	PA-100	AMC	CIP	FOS	NIT	TMP
S	S	10 (83%)	8 (80%)	9 (69%)	10 (77%)	12 (100%)
	I	0 (0%)	2 (20%)	1 (8%)	0 (0%)	0 (0%)
	R	2 (17%)	0 (0%)	3 (23%)	3 (23%)	0 (0%)
	Total	12	10	13	13	12
I	S	0 (0%)	1 (33%)	0 (0%)	1 (100%)	0 (0%)
	I	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	R	0 (0%)	2 (67%)	0 (0%)	0 (0%)	0 (0%)
	Total	0	3	0	1	0
R	S	0 (0%)	0 (0%)	2 (100%)	3 (100%)	2 (67%)
	I	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)
	R	4 (100%)	1 (50%)	0 (0%)	0 (0%)	1 (33%)
	Total	4	2	2	3	3

Table 5: Antibiotic susceptibility testing by PA-100 POC system compared to the reference laboratory test for five antibiotics, according to EUCAST breakpoints (S: susceptible, I: susceptible, increased exposure, R: resistant).

The overall categorical agreement between the intervention test (PA-100) and the reference method was calculated to be 80.6%, again, defined as the proportion of results for which both methods assigned the same EUCAST category.

	AMC	CIP	FOS	NIT	TMP
Categorical agreement (95% CI)	83.3% (55.2-95.3)	75.0% (46.8-91.1)	75.0% (46.8-91.1)	76.9% (49.7-91.8)	92.3% (66.7-98.6)
Sensitivity (95% CI)	71.4% (35.9-91.8)	80.0% (44.4-97.5)	81.8% (48.2-97.7)	76.9% (46.2-95.0)	85.7% (48.7-97.4)
Specificity (95% CI)	100% (51.0-100)	83.3% (35.9-99.6)	0% (0-84.2)	0% (0-70.8)	33.3% (6.0-75.9)
PPV (95% CI)	100% (56.6-100)	88.9% (51.8-99.7)	81.8% (48.2-97.7)	76.9% (46.2-95.0)	92.3% (62.1-99.6)
NPV (95% CI)	66.7% (30.0-90.3)	71.4% (35.9-91.8)	0% (0-84.2)	0% (0-70.8)	20.0% (3.6-62.4)

Table 6: Performance values on antibiotic susceptibility testing by PA-100 POC system compared to the reference laboratory test for five antibiotics

An error analysis was performed on this dataset, where major errors (ME) were defined as cases in which the PA-100 classified a sample as resistant while the reference laboratory method classified it as susceptible. Very major errors (vME) were defined as cases in which the PA-100 test classified a sample as susceptible while the laboratory classified it as resistant (Table 7). Positively, no very major errors were observed which may indicate that the PA-100 AST device is suitable for use in clinical practice. However, several major errors were identified where the PA-100 system overestimated resistance compared to the reference method.

Antibiotic	Major Error	Very Major Error
AMC	1	0
CIP	0	0
FOS	2	0
NIT	3	0
TMP	1	0

Table 7: Error analysis on PA-100 AST compared to the reference test

3.4 User friendliness

To evaluate the user-friendliness of the PA-100 POC device, all healthcare providers who interacted frequently with the POC device during the study were asked to complete the SUS questionnaire based on their experience. In total, 6 GPs and 1 urologist filled in the questionnaire. The SUS responses were then converted into a total usability score according to the above-described scoring procedure, resulting in a value between 0 and 100. This approach provided us

with a total mean score of 77,86, corresponding to a B+ rating according to the grading scale proposed by Sauro and Lewis and placing the system in the 80-84th percentile.

Based on our own experience and discussions with participating healthcare providers, the PA-100 AST device's strongest qualities are its intuitive, self-explanatory design, which minimizes the need for technical support. It is quick to learn thanks to the availability of well-structured online training courses. It is a relatively compact device (200x220x360mm) that should be easily accommodated within a general practice setting. However, most GP practices do not have a dedicated laboratory space, so the device was often placed in shared areas such as the kitchen or the secretary's office. In these environments, the device's operational noise was noted to be a potential drawback.



Figure: PA-100 AST System [18]

In terms of workflow integration, the test requires relatively little active time from the healthcare provider. However, it does introduce a minor interruption to the standard consultation and a slightly longer waiting period for therapy prescription for the patient. Generally, patients did not seem to mind this brief delay, as the prescription was usually targeted rather than empiric and thus did not need to be adjusted retrospectively once laboratory results become available. The consultation interruption, however, may become more challenging during busy periods or when performing a POCT at the end of the working day.

In practice, the POCT required a few additional minutes after the consultation to initiate the test, followed by a 15-45-minute waiting period for results, during which consultations could continue as normal. Subsequently, a few extra minutes were needed to recontact the patient (mostly by phone) with the results and provide an electronic prescription.

4. Discussion

4.1 Main findings

We here present our preliminary findings of the study, since at the time of write the sample size was not yet reached. Therefore we should treat these results with caution. The sensitivity of 80.95% corresponded to a 95% CI of 58.1% to 94.6%, while the specificity of 89.71% corresponded to a 95% CI of 79.9% to 95.8%. These relatively wide confidence intervals, particularly for sensitivity, reflect the limited number of positive samples included in the study. Overall, the device demonstrated a high level of diagnostic accuracy. The total categorical agreement, defined as the proportion of correctly classified samples, was 87.6%. These results indicate that the PA-100 AST system is capable of reliably detecting the majority of bacteriuria-positive samples, while also maintaining a strong ability to correctly exclude negative cases. However, the number of false positives (n = 7) indicates a moderate risk of overestimation of UTIs.

The positive predictive value (PPV) of the PA-100 was 70.8% with a 95% CI of 48.9% to 87.4%, while the negative predictive value (NPV) was much higher at 93.8% with a 95% CI of 84.8% to 98.3%. This shows that the PA-100 is more reliable for ruling out bacteriuria and less suitable for ruling in infection. The test did not show a statistically significant difference between both methods ($p = 0.548$), suggesting that the discrepancies observed are likely due to random variation rather than a systematic bias in one direction.

Taken together, these findings demonstrate that the PA-100 AST system provides a reliable approximation of standard laboratory results for both the detection of bacteriuria and the assessment of antibiotic susceptibility. The device combines a good sensitivity with a high specificity, resulting in a favourable overall diagnostic performance.

4.2 Comparison with existing literature

Compared to the 2023 Alonso Tarrés *et al* study, our dataset shows a lower overall performance of the PA-100 system, with a categorical agreement of 80.6% versus their 94.6% (reported under instructed-for-use conditions). Despite our lower specificity value (89.7% compared to 99.4% in their study), our findings similarly generate a relatively lower sensitivity (80.95% compared to 84.0% in their study) and thus, a tendency toward conservative classification [20].

The observed sensitivity (80.95%) and specificity (89.71%) are broadly in line with previously reported performance characteristics of the device, although somewhat lower than those obtained under controlled conditions. This discrepancy could be explained by a variability in sample quality, not obtaining the final sample size, bacterial load, and operator experience.

4.3 Clinical implications

The relatively limited number of false negatives (n = 4) suggests that few clinically relevant infections are missed, which is essential in a primary care context. Similarly, the high NPV (93.8%) is reassuring and indicates that a susceptible test result can safely be used for treatment initiation. This is especially applicable in uncomplicated UTIs, where AMR is generally low.

The presence of false positives, however, indicates potential overtreatment, something that is contrary to our goal of slowing down AMR. It was seen that most discrepancies were situated around clinical breakpoints, which is a known challenge in AST interpretation and not unique to this device. Importantly, clinically critical errors, such as misclassification of resistant strains as susceptible, appeared to be limited, suggesting that the device could be safely used as a supportive tool in guiding antibiotic therapy.

One of the key selling points of the PA-100 system is its rapid turnaround time, delivering bacteriuria results within 30 minutes and full AST profiles within 45 minutes. While this is promising to reduce empiric antibiotic prescribing, this study did not study the impact on prescribing behaviour or clinical outcomes. This remains an important area for future research.

The user friendliness assessment provided a mean System Usability Score of 77.86, placing it in an above-average category. This rating is supported by qualitative feedback from participating healthcare providers, who appreciated the intuitive design and fast learning curve of the device. These qualities are important for successful implementation in first line healthcare, where limited timing and technical expertise are frequent obstacles.

Despite these strengths, some practical challenges were identified such as the integration of the device into routine workflow and a slightly delayed prescription process. While generally well tolerated by patients, it may become more challenging in busier time periods. Addressing these aspects could further enhance user satisfaction and facilitate broader implementation in routine practice.

4.5 Strengths and limitations

Some limitations should be considered in this evaluation. Most participating general practitioners reported limited prior experience with similar point-of-care diagnostic devices. This, together with the limited duration of exposure to the device, means that not all participants were fully routinized in its use. Therefore, this score can be interpreted more as representative of early adoption rather than long-term, optimized use in daily clinical practice.

The limited sample size (n = 96) and relatively small number of bacteriuria-positive urine samples are reflected in the wider confidence intervals. This limits the statistical power and precision of

the results, therefore, this study should be viewed as a work-in-progress and larger-scale research is required to provide more precise estimates of these primary endpoints. Additionally, the study population was not diverse as no pregnant women were included and only a small number of high-risk patients were enrolled. Therefore, these conclusions may not be representative of all patients with suspected UTIs.

In addition, only few (29.2%) follow-up data were collected for patients included in this study. While this reflects real-world clinical practice and considering this primary setting, we can assume that a large proportion of patients without follow-up did not return because their complaints had resolved. Still, it remains unclear how diagnostic results translated into clinical outcomes, and whether initial classifications were confirmed or adjusted over time.

Potential bias related to the study setting should also be considered. Samples were collected in both urology and general practice settings, which are known to have different patient populations and disease prevalence. This variation may have influenced the observed diagnostic performance, as prevalence directly impacts measures such as predictive values.

5. Conclusion

In conclusion, this study contributes to the assumption that the PA-100 AST System can be a useful tool to aid ambulatory healthcare providers in their clinical decisions and prescription choices. The POCT results are generally in line with standard laboratory diagnostics while being more rapid and accessible in ambulatory care settings. Currently, the device seems particularly valuable as a supportive tool, as the presence of false positives suggests it shouldn't replace conventional diagnostics entirely. The relatively low number of false negatives and high NPV, however, is reassuring, since missing infections would make it unfavorable in primary care. This study is not performed on a large enough scale to state conclusions that can be applied to a broader population. However, the PA-100 results are promising and suggest that in time, and with more detailed analyses, the device can change the way antibiotics are prescribed.

6. Acknowledgments

Several people contributed to making this master's thesis possible and bringing it to completion. We would like to thank our promoter, Prof. Dr. Jan Verbakel, for the guidance and support during the past three years. Secondly, our sincere gratitude goes to our co-promotor, Tine De Burghgraeve, for always being available, for her kindness and for providing constructive feedback throughout the process. We would like to acknowledge the participating physicians from AZ Diest, RZ Tienen and the general practices in Antwerp, Vosselaar and Leuven for their time and willingness to contribute to this study. Finally, we sincerely thank our family and friends for their encouragement, patience, and support during the completion of this thesis and our HAIO years in general.

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8. Appendices

Appendix 1: Ethics Committee approval

UZ LEUVEN

Leuven, 30 Jul 2025

Ethics Committee
Research UZ/KU Leuven
UZ Leuven
Herestraat 49
B 3000 Leuven (Belgium)
Tel +32 16 34 86 00
Email : ec@uzleuven.be

prof. dr. Jan Verbakel

Our reference:	EudraCT-nr:	Belg. Regnr:
S70064		B3222025001725

Clinical performance of Astrego PA-100 point of care device in ambulatory care.

Positive advice in accordance with the law of 7 May 2004 on experiments on the human person

Dear colleague

The Ethics Committee Research (EC Research) UZ/KU Leuven has examined and discussed the above mentioned dossier in the meeting held on 02 Jun 2025.

After having consulted the additional information and/or adapted documents relating to this dossier, EC Research considers that the proposed study, as described in the protocol, is scientifically relevant and ethically justified. After consulting the Ethics Committee of the other participating centres, it therefore gives on 30 Jul 2025 a favourable opinion on this study.

EC Research emphasizes the responsibility of the PI/promotor of this study concerning the privacy of the participants'/patients' data. Additionally, all access to patient data by students or coworkers should occur under the responsibility and supervision of the PI/promotor (including the use of personal data in electronic/digital tools). The PI/promotor is responsible for the implementation of the project proposal in accordance with applicable laws and regulations including, but not limited to, the EU regulation 2016/679 (General Data Protection Regulation), the Belgian Law on patients' rights of 22/8/2002, and the policy of the institution where the research will be carried out.
EC Research refers to the ICH/GCP guidelines on its website, and confirms that a GCP-training is required for each investigator. It is the responsibility of the principal investigator that each member of the study team has a valid GCP-certificate(i.e. a certificate obtained not longer than 3 years ago).

EC Research underlines the sponsor's responsibility for the use of the application/digital tool in this clinical study. More specifically, the sponsor should conduct all essential GDPR checks to make sure the use of this application/tool is justified, GDPR compliant

and safe for the processing of sensitive personal data.
The patient should be well informed about the terms, conditions and costs of application. Furthermore, the sponsor's obligations should not be compromised by these terms and conditions, especially in terms of privacy protection of the patient. Please inform the patient about additional costs (if any) that are linked to the usage of the application/tool. This information should be added to an updated ICF, if necessary, in a subsequent amendment to the study.
Finally, EC research emphasizes that only essential data for the purpose of the application/tool can be collected (cf. GDPR principle of data proportionality and minimization).

For the assessment of this dossier, documents/answers received on 16 May 2025, 23 May 2025 and 29 Jul 2025 have been taken into account.

The favourable advice concerns:

Protocol:
v 2.0 – Date 24/06/2025
Informed Consent Form:
ICF v2 dd 25Jun2025 Nl
Other subject information documentation:
Midstream urine FO.PUB.8 versie 2
Proof of "no-fault" insurance cover:
Covered by UZ Leuven insurance which is renewed annually.
GDPR questionnaire:
dd 16May2025; PRET accepted dd 2025-07-18

EC Research confirms working in accordance with the ICH-GCP principles (International Conference on Harmonization Guidelines on Good Clinical Practice), the latest version of the Declaration of Helsinki, the Oviedo Convention on Human Rights and Biomedicine and applicable laws and regulations.

EC Research confirms that members with a potential conflict of interest abstain from voting.

List of members: see appendix.

Points of concern: (if applicable)

The conformity of translated documents compared to the Dutch documents, is the responsibility of the sponsor.

We would like to draw your attention to the fact that EC Research expects her initial comments to be taken into account ab initio at the next submission by the same sponsor.

*Provided that there is a **Clinical Trial Agreement**, the study can only start when the Clinical Trial Agreement has been approved and signed by the CEO of UZ Leuven (and/or by an authorized representative of KU Leuven R&D).*

Please take into account the regulations of the hospital concerning tissue management and the regulations of the law of December 19, 2008.

It is important to note that approval from EC Research is required for all use of e-consent before the process can start. This is a crucial step to ensure that all ethical considerations and regulations are adhered to. For more detailed information regarding the policy and procedure concerning e-consent in REDCap, we kindly refer you to the specific page on the CTC Datamanagement website: https://gbiomed.kuleuven.be/english/ctc/intern/data-management/econsent

This favourable advice from EC Research does not imply that EC Research can be held accountable for the planned study. You will remain responsible for the study. In addition, you should ensure that your opinion as principal investigator is reproduced in publications of study results, reports for the government, etc.

The EC approval granted for a specific project, is valid for one year.

If the study will not be terminated within a year, the ICH-GCP demands that an annual progress report will be provided to EC Research. We also request you to inform us if the study will not be initiated or if the study does not start within 1 year after approval.

Finally, the termination (early or planned) of the study should be reported within the legal deadlines.

Yours sincerely,



Prof. Dr. Minne Casteels
Chair
Ethics Committee Research UZ Leuven

Cc:
FAMHP (Federal Agency for Medicines and Health Products)

CTC (Clinical Trial Center UZ Leuven)

EXTERNAL Committees :

1. EC Research has taken into account the opinion of the following local committees (s). EC Research therefore assumes that these centres will accept the study, unless otherwise notified

Local Committee	*Principal investigator*	*Date advice*
RZ Heilig Hart Tienen	dr. Evert Baten	23 Jun 2025
UZ Leuven	dr. Lien Appelen	23 Jun 2025
UZ Leuven	dr. Pieter Dekelver	23 Jun 2025
AZ Diest	dr. Evert Baten	26 May 2025

2. The following committee(s) has (have) issued a negative opinion:

   Local Committee *Principal investigator*

3. EC Research did not receive any advice from the committee(s) below. Consequently, these centres cannot participate in this study (cf. Law of 7 May 2004). These centres can only be added to the study by a substantial amendment.

   Local Committee *Principal investigator*

4. EC Research received the advice of the local committee(s) below too late (i.e. after sending out the first remark letter). Consequently, these centres cannot participate in this study (cf. Law of 7 May 2004). These centres can only be added to the study by a substantial amendment.

   Local Committee *Principal investigator*

List of members EC Research UZ/KU Leuven

Chair	prof. dr. Maria-Reinhilde Casteels	Clinical Pharmacology
Vice chair	prof. dr. Dominique Bullens	Paediatrics
	De heer Aernout De Raemaeker	Medical Legislation alternate
	De heer Jean-Jacques Derèze	Medical Legislation alternate
	De heer Mathijs Swaak	Healthy volunteer repres.
	Mevr. Dorien Fierens	Medical Legislation alternate
	Mevr. Katelijne Van Overwalle	Pt representative (alternate)
	Mevr. Kelly Hoogeveen	Nurse
	Mevr. Lia De Wilde	Pt representative (alternate)
	Mevr. Marie Gilliot	Medical Legislation alternat
	Mevr. Marilien Vandeputte	Nurse
	Mevr. Teresia De Fraye	Pt representative
	Mevr. Valerie Christens	Medical Legislation alternat
	Mevr. Veerle Vanparys	Pharmacist (alternate)
	dr. Ellen Deleus	Abdominal surgery
	dr. Kristel Van Landuyt	Bioband
	dr. Lut De Groote	General Practitioner
	dr. Marleen Renard	Paediatrics
	dr. Walter Janssens	Clinical Pharmacology
	prof. André Loeckx	Pt representative (alternate)
	prof. Ben Van Calster	Statistics
	prof. Guy Bosmans	Clin. Psychology (alternate)
	prof. Kristin Verbeke	TARGID
	prof. Pascal Borry	Ethics (alternate)
	prof. Rik Gosselink	Revalidation
	prof. dr. Anne Smits	Paediatrics
	prof. dr. Anne Uyttebroeck	Paediatrics
	prof. dr. Ariel Alonso	Statistics (alternate)
	prof. dr. Bart Van der Schueren	Endocrinology / Pharmacology
	prof. dr. Catherine Cassiman	Ophthalmology
	prof. dr. Francesca Bosisio	Pathology
	prof. dr. Frank Van Calenbergh	Neurosurgery
	prof. dr. Frederik Nevens	Hepatholgy
	prof. dr. Gregor Verhoef	Haematology
	prof. dr. Heleen Delbeke	Ophtalmology
	prof. dr. Jan Verhaegen	Laboratory Medicine
	prof. dr. Jan de Hoon	Clinical Pharmacology
	prof. dr. Karin Sipido	Experimental Cardiology
	prof. dr. Koen Luyckx	Clin. Psychology (alternate)
	prof. dr. Laura Van Gerven	ORL
	prof. dr. Maria Schetz	Intensive care
	prof. dr. Peter Sinnaeve	Cardiology
	prof. dr. Simon Brumagne	Physiotherapy
	prof. dr. apr. Erwin Dreesen	Pharmacist

Leuven, 21 November 2025

Ethics Committee
Research UZ/KU Leuven
Herestraat 49
B 3000 Leuven (Belgium)

Email : ec@uzleuven.be

prof. dr. Jan Verbakel

Our reference:	EudraCT-nr:	Belg. Regnr:
S70064		B3222025001725

Clinical performance of Astrego PA-100 point of care device in ambulatory care.

Modification/additional study documents

AMEND-Id: 0001

Dear colleague

The Ethics Committee Research (EC Research) UZ/KU Leuven has initially given a positive advice for the above mentioned protocol on 30 July 2025.

Documents/answers received on 17 November 2025 and 19 November 2025 have been taken into account in the evaluation of the modification.

A favourable advice for this modification was given on 21 November 2025.

The favourable advice concerns:

Addition site(s)

Groepspraktijk Brugberg
Diestsesteenweg 49, 3010 Leuven
dr Jan Verbakel

The following documents were submitted for notification:

Not applicable

EC Research emphasizes the responsibility of the PI/promotor of this study concerning the privacy of the participants'/patients' data. Additionally, all access to patient data by students or coworkers should occur under the responsibility and supervision of the PI/promotor (including the use of personal data in electronic/digital tools).

EC Research confirms working in accordance with the ICH-GCP principles (International Conference on Harmonization Guidelines on Good Clinical Practice), the latest version of the Declaration of Helsinki, the Oviedo Convention on Human Rights and Biomedicine and applicable laws and regulations.

EC Research confirms that members with a potential conflict of interest abstain from voting.

List of members: see appendix.

Points of concern: (if applicable)

The conformity of translated documents compared to the Dutch documents, is the responsibility of the sponsor.

In case of modifications to protocol and/or clinical trial agreement for UZ Leuven, these must also be submitted to the Clinical Trial Center (CTC) of UZ Leuven.

We would like to draw your attention to the fact that EC Research expects her initial comments to be taken into account ab initio at the next submission by the same sponsor.

Please take into account the regulations of the hospital concerning tissue management and the regulations of the law of December 19, 2008.

Please take into account the guidance document on the use of electronic informed consent (e-consent): https://overlegorganen.gezondheid.belgie.be/nl/documenten/guidance-sponsors-use-electronic-informed-consent-interventional-clinical-trials-0

This favourable advice from EC Research does not imply that EC Research can be held accountable for the planned study. You will remain responsible for the study. In addition, you, as involved principal investigator, should ensure that your opinion as an involved researcher is reproduced in publications of the study results, reports for the government, etc.. You are reminded that concerning clinical studies, any observed serious event needs to be reported immediately to the sponsor and the ethics committee, even if the causal relationship with the study is unclear.

We request you to inform us if the study will not be initiated.

Finally, the termination (early or planned) of the study should be reported within the legal deadlines. and provide the Clinical Study Report (CSR) to EC Research.

Yours sincerely,



Prof. dr. Minne Casteels
Chair
Ethics Committee Research UZ Leuven

Cc:
FAMHP (Federal Agency for Medicines and Health Products)

CTC (Clinical Trial Center UZ Leuven)

Participating centres

Local Committee	*Principal investigator*	*Date advice*
RZ Heilig Hart Tienen	dr. Evert Baten	23 June 2025
UZ Leuven	dr. Lien Appelen	23 June 2025
UZ Leuven	dr. Pieter Dekelver	23 June 2025
AZ Diest	dr. Evert Baten	26 May 2025

List of members EC Research UZ/KU Leuven on 21 November 2025:

Chair	prof. dr. Maria Reinhilde Casteels	Clinical Pharmacology
Vice chair	prof. dr. Dominique Bullens	Paediatrics
	De heer Aernout De Raemaeker	Medical Legislation alternate
	De heer Jean-Jacques Derèze	Medical Legislation alternate
	De heer Mathijs Swaak	Healthy volunteer repres.
	De heer Simon Brumagne	Physiotherapy
	Mevr. Dorien Fierens	Medical Legislation alternate
	Mevr. Katelijne Van Overwalle	Pt representative (alternate)
	Mevr. Kelly Hoogeveen	Nurse
	Mevr. Lia De Wilde	Pt representative (alternate)
	Mevr. Marie Gilliot	Medical Legislation alternat
	Mevr. Marilien Vandeputte	Nurse
	Mevr. Teresia De Fraye	Pt representative
	Mevr. Valerie Christens	Medical Legislation alternat
	Mevr. Veerle Vanparys	Pharmacist (alternate)
	dr. Ellen Deleus	Abdominal surgery
	dr. Kristel Van Landuyt	Biobank
	dr. Lut De Groote	General Practitioner
	dr. Marleen Renard	Paediatrics
	dr. Walter Janssens	Clinical Pharmacology
	em. prof. dr. Frederik Nevens	Hepatholgy
	em. prof. dr. Gregor Verhoef	Haematology
	em. prof. dr. Maria Schetz	Intensive care
	prof. André Loeckx	Pt representative (alternate)
	prof. Ben Van Calster	Statistics
	prof. Guy Bosmans	Clin. Psychology (alternate)
	prof. Kristin Verbeke	TARGID
	prof. Pascal Borry	Ethics (alternate)
	prof. dr. Anne Smits	Paediatrics
	prof. dr. Anne Uyttebroeck	Paediatrics
	prof. dr. Ariel Alonso	Statistics (alternate)
	prof. dr. Bart Van der Schueren	Endocrinology / Pharmacology
	prof. dr. Catherine Cassiman	Ophthalmology
	prof. dr. Francesca Bosisio	Pathology
	prof. dr. Frank Van Calenbergh	Neurosurgery
	prof. dr. Heleen Delbeke	Ophtalmology
	prof. dr. Henricus Gosselink	Revalidation
	prof. dr. Jan de Hoon	Clinical Pharmacology
	prof. dr. Karin Sipido	Experimental Cardiology
	prof. dr. Koen Luyckx	Clin. Psychology (alternate)
	prof. dr. Laura Van Gerven	ORL
	prof. dr. Peter Sinnaeve	Cardiology
	prof. dr. apr. Erwin Dreesen	Pharmacist

Appendix 2: Case Report Form

Datum inclusie (baseline visite):	(DD/MM/YYYY)
Inclusiecriteria:	
1. Voluntary written informed consent of the participant or their legally authorized representative has been obtained prior to any screening procedures 2. At least 18 years old at time of signing the Informed Consent Form 3. Patients visiting a clinician in ambulatory care with symptoms of a suspected uncomplicated urinary tract infection < 7days 4. No antibiotics taken in de previous 5 days 5. Willing to provide a clean-catch midstream urine sample or a urine sample by probing	JA/NEEN
Exclusiecriteria:	
1. Patients with anatomical anomality's or renal disease 2. Patients younger than 18 years at the time of signing the ICF 3. Hospitalised patients, patients presenting to emergency department	JA/NEEN
Algemene info	
Geslacht	□ Man □ Vrouw □ X □ Zeg ik liever niet
Geboortedatum:	
Zwanger:	JA/NEEN
Duur van deze ziekte episode, vanaf de eerste symptomen:	In dagen/uren
Belangrijke medische voorgeschiedenis:	
Behoort tot risicogroep:	JA/NEEN
Zo ja, welke? ○ Diabetes mellitus ○ Verminderde weerstand ○ Neurologische blaasfunctiestoornissen	JA/NEEN
Anamnese	

☐ pijnlijke of branderige mictie ☐ ernst en locatie van de pijn ☐ toegenomen mictiefrequentie ☐ hematurie ☐ eerdere episodes met vergelijkbare klachten ☐ recent invasief onderzoek van blaas of prostaat of recente katheterisatie ☐ loze aandrang ☐ pijn in de rug of onderbuik ☐ tekenen van weefselinvasie: o koorts o (koude) rillingen o algemeen ziek zijn o flank- of perineumpijn o tekenen van een delier o tekenen van sepsis ☐ bij eerdere urineweginfecties eventuele kweekresultaten (tot 1 jaar terug) ☐ andere:	
Klinisch onderzoek: nvt, normaal, afwijkend (indien afwijkend specifieer)	
Buikonderzoek *(Let op: peritoneale prikkeling, flankpijn, slagpijn in de nierloge, urineretentie)*	
Genitaal onderzoek	
Vaginaal toucher	
Rectaal toucher	
Lichaamstemperatuur	….°C
Urine Dipstick Test	
Diagnose	
❑ Cystitis ❑ Pyelonefritis ❑ Seksueel Overdraagbare Aandoening (SOA) ❑ Incontinentie ❑ Prostatitis ❑ Geen ziekte ❑ Andere:	
Beleid na consultatie ❑ Geruststellen/afwachten ❑ Opstart ambulante therapie: indien ja, welke therapie	

❑ Verwijzing naar 2e of 3e lijn: indien ja, welke dienst, locatie, clinicus	
Follow-up ❑ Volledige opklaring van de klachten ❑ Persisterende klachten (specifieer):	

	Nvt	Normaal	Afwijkend	Specifieer indien afwijkend
Urineonderzoek *(WBC, RBC, SOA...)*				
Bloedonderzoek *(CRP, eGFR...)*				
Vaginale wisser				
Urethrale wisser				

Lab: presence of bacteriuria (≥ 50,000 CFU/mL)	Yes or no
AST results: amoxicillin/clavulanic acid	S (susceptible), I (susceptible, increased exposure), R (resistant) or not applicable
AST results: ciprofloxacin	S (susceptible), I (susceptible, increased exposure), R (resistant) or not applicable
AST results: fosfomycin	S (susceptible), I (susceptible, increased exposure), R (resistant) or not applicable
AST results: nitrofurantoin	S (susceptible), I (susceptible, increased exposure), R (resistant) or not applicable
AST results: trimethoprim	S (susceptible), I (susceptible, increased exposure), R (resistant) or not applicable

PA-100: presence of bacteriuria (≥ 50,000 CFU/mL)	Yes or no
AST results: amoxicillin/clavulanic acid	S (susceptible), I (susceptible, increased exposure), R (resistant) or not applicable
AST results: ciprofloxacin	S (susceptible), I (susceptible, increased exposure), R (resistant) or not applicable
AST results: fosfomycin	S (susceptible), I (susceptible, increased exposure), R (resistant) or not applicable
AST results: nitrofurantoin	S (susceptible), I (susceptible, increased exposure), R (resistant) or not applicable
AST results: trimethoprim	S (susceptible), I (susceptible, increased exposure), R (resistant) or not applicable

Appendix 3: System Usability Scale

System Usability Scale Questionnaire	Strongly Disagree				Strongly Agree
1. I think that I would like to use this product frequently.	1	2	3	4	5
2. I found the product unnecessarily complex.	1	2	3	4	5
3. I thought the product was easy to use.	1	2	3	4	5
4. I think that I would need the support of a technical person to be able to use this product.	1	2	3	4	5
5. I found the various functions in the product were well integrated.	1	2	3	4	5
6. I thought there was too much inconsistency in this product.	1	2	3	4	5
7. I imagine that most people would learn to use this product very quickly.	1	2	3	4	5
8. I found the product very awkward to use.	1	2	3	4	5
9. I felt very confident using the product.	1	2	3	4	5
10. I needed to learn a lot of things before I could get going with this product.	1	2	3	4	5