

# Phase-contrast Microscopy of fresh Urine as Entrustable Professional Activity (EPA) for Practice Nurses

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## **ABSTRACT**

What follows is an essay on my planned Medical Doctoral (MD) research project at the Department of General Practice, University Hospital Wuerzburg, Germany. It aims to implement a competency-based educational intervention addressed to general practice teams (primarily practice nurses) training them in point-of care – phase-contrast microscopy of fresh urines. Furthermore, it aims at exploratively evaluating the educational intervention's feasibility and effectiveness, focusing on the practice nurses' learning gain and experiences. The study will be embedded in a cluster-randomized pilot trial assessing the effects of point-of-care tests (microscopy and urinary dipsticks) on antibiotic use in women with uncomplicated urinary tract infections in primary care. The present essay begins with summarizing the current diagnostic and treatment guidance on uncomplicated UTI. Thereafter, after a rapid review of the current definition and components of competency-based medical education (CBME), I outline the principles of how competence gain should be evaluated in CBME, exploring the usefulness of implementing teaching sessions addressed to professionals as an Entrustable Professional Activity. Finally, I conclude by provisionally outlining the planned quantitative and qualitative research methods, as well as a project timeframe.

## **BACKGROUND**

### **Evidence summary – Uncomplicated urinary tract infections in women**

A Urinary tract infection (UTI) is defined as a symptomatic inflammation of the urinary tract caused by a bacterial infection.

Risk factors for a UTI are the following: sexual intercourse, use of spermicides, use of medroxyprogesterone acetate, use of antibiotics in the previous 2-4 weeks, previous UTIs, anatomical or functional abnormalities of the genitourinary tract, diabetes mellitus.

They can be classified as *lower UTI*, which is an infection of the bladder (also known as *cystitis*) and *upper UTI*, which is an infection of the upper part of the urinary tract i.e., the ureters and kidneys (pyelonephritis [PN]). Furthermore, UTIs can be classified as *complicated* or *uncomplicated*. Complicating factors are male sex, young age (children), pregnancy, anatomical or functional abnormalities of the genitourinary tract or the kidneys, history of recent instrumentation, immunosuppression, fever, and flank pain. Additionally, a UTI is considered complicated if the patient had an indwelling urinary catheter, had an antibiotic course, or had a hospital/nursing-home stay in the previous two weeks.

Predictive signs for a PN are flank pain and fever >38°C. In the latter case the patient should be managed as having a complicated UTI [1].

Asymptomatic bacteriuria is defined as the presence of bacteria in the patient's urinary tract in absence of symptoms and signs. It is condition and not a disease and should be treated with antibiotics only in pregnant women or prior to surgical procedures in the urinary tract.

Recurrent UTI is defined as having more than three UTI per year or more than two UTI in the last 6 months [1].

In general practice, UTIs are the most common bacterial infection and a common reason of consultation. In Germany, it is estimated that women have an annual prevalence of uncomplicated UTI ranging from 8.7% to 11%, whereas PN is less common (annual prevalence 0.16%) [1]. These figures are consistent with those from other countries [2].

In 73%-80% of cases, UTI are caused by *Escherichia coli*. Other pathogens are less frequent as *Enterococcus spp.* (3-13%), *Proteus spp.* (5%), *Staphylococcus spp.* (5-8%), and *Klebsiella pneumoniae* (7%).

The diagnosis is primarily based on clinical history. Typical symptoms and signs suggesting a UTI are dysuria, pollakiuria, nycturia, incontinence, suprapubic pain, urine cloudiness, offensive urine smell, macrohematuria, fever, a previous UTI and other risk factors for an infection [1, 3, 4]. Vaginal discharge and irritation decrease the likelihood of a UTI. If the patient's history is inconclusive, a dipstick test should be performed, primarily to rule in the diagnosis of UTI. The likelihood of a UTI increases if the dipstick test shows either nitrites and leukocytes, only nitrite, or leukocytes and erythrocytes. Conversely, history-taking with dipstick analysis alone is not suitable to rule out the diagnosis definitely [5].

Urine culture is the reference test to diagnose and to guide treatment of UTIs [3, 6]. However, performing a urine culture to all patients presenting with symptoms of an uncomplicated UTI (unUTI) is not recommended. In primary care, a urine culture should only be arranged in case of recurrent UTI, specific risk factors for infection and/or complicated UTI, and when there is a need to rule out the diagnosis definitely (e. g. pregnant women) [1].

All women with unUTI should be informed that they have a benign disease, even if recurrences are frequent, and that most unUTI resolve spontaneously within 5-7 days. However, the therapeutic goal is the quick relief of symptoms. First-line antibiotics are Fosfomycin-Trometamol, Nitrofurantoin, Nitroxoline and Pivmecillinam. Trimethoprim is no longer a first-line treatment but may be prescribed if resistance rates are below 20%.

Non-antibiotic treatment strategies to obtain symptom control (e.g. Ibuprofen, herbal treatment with Uva Ursi or others), can be considered as a first-line option sharing the therapeutic decision with patients [1].

### **Rationale of the MicUTI trial in which the study reported here will be embedded**

As outlined above, currently a management based on symptoms and signs, aided by dipstick analysis is the common approach in primary care [4]. This strategy can lead to false positive diagnoses, thus to overtreatment, or to false negatives, thus to possible undertreatment [3, 7, 8]. Concerning the latter, in unUTI serious complications are seldom and the treatment goal is to obtain symptomatic relief rather than reducing complication rates [1, 4]. On the contrary, overtreatment can lead to undesired side-effects of antibiotics, primarily to antimicrobial resistance (AMR) [9, 10].

Thus far, with the intent to achieve a more accurate diagnosis while lowering antibiotic use in women with suspected UTI in general practice, portable devices to perform urine culture and susceptibility tests for the most common antibiotics have been evaluated. The studies were inconclusive [11-13], which is likely due to the fact that the evaluated point-of-care (PoC)-culture device takes one day to deliver definitive results, making this method not suitable to take rapid decisions. Until now, the only rapid PoC-test able to directly detect bacteria in urine that was evaluated in a general practice setting is urine microscopy. Among the various microscopic methods, phase-contrast microscopy is commonly used in some countries, e. g. in Denmark, as it does not require centrifugation or other time-consuming techniques,

enabling therefore the method to be easily implemented in practice [14]. According to a systematic review, “phase-contrast microscopy seems to be an accurate valid and feasible screening-test for bacteriuria in patients with symptoms of UTI in general practice” [15].

A Recent individual participant data meta-analysis found that both, erythrocytes, and bacteria in urine have moderating effects on treatment outcomes in women with unUTI, thus these factors make incomplete recovery more likely. Taking these findings into account, studies that evaluate rapid, easy to implement, and cost-effective methods to reliably detect bacteria at the point-of-care are needed. In this way, antibiotics could be targeted only to those women who are more likely to benefit from this treatment, namely those with erythrocytes and bacteria in their urine [16]. As stated above, to date, phase-contrast microscopes are devices able to detect bacteria at the point-of-care. What remains unclear is the effect of its use in general practice on antibiotic prescriptions, as well as its diagnostic accuracy. To give an answer to this research question, the MicUTI (Microscopy in Urinary Tract Infections) pilot trial was set up to inform on feasibility of a full-scaled RCT in German general practice and to provide first data on the effect of a phase-contrast-microscopy and dipstick informed management strategy on antibiotic use.

### **Rationale of the present study**

In the context of MicUTI, to train the practice teams in PoC-microscopy, a competency-based educational course will be delivered primarily to practice nurses. The microscopy on fresh urine will be formulated as an Entrustable professional Activity (EPA).

#### *Competency-based medical education and the concept of entrustable professional activity*

Competency-based Medical Education (CBME) is a relatively new approach which provides a high educational standard while ensuring that graduates acquire all required knowledge, skills and attitudes to be competent in a given domain [17]. CBME gained popularity in the late 90s and early 2000s, it was firstly described in Canada, United States, Netherlands and United Kingdom and is now established in many countries [18]. In this approach, competencies themselves are the outcome of teaching i.e., the learning goals that the learner must have achieved as he/she completes the program. This concept moved medical education away from time- and process-based teaching, leading to an evolution into outcome-based teaching, where the outcome is predefined by competencies representing the learning objectives [19]. Through CBME, trainees get better prepared for clinical practice, with the education being more efficient, flexible, and centered on the learner. At the same time, this outcome can be derived from, and adjusted to the needs of the health system to ensure that learners, for instance medical graduates, become able to deliver optimal health care [19]. Ten Cate described in 2005 what these competencies need to fulfill in CBME: they should be specific, long-lasting, trainable, measurable, linked with other competencies and associated with a professional task, for which knowledge, skills and attitudes are required [20].

Once competencies are specified as learning goals, the assessment of the trainees should be planned [21]. To determine when the learner has achieved all the learning objectives and is ready to work in the clinic is challenging and the traditional CBME approach seems to have its limitations in this assessment. Achieving competencies means to have the ability of managing a certain task. The required knowledge, skills and attitudes [22] do not automatically lead to an adequate performance in clinical practice nor does they imply that the learner performs properly in every situation [21]. In other words, if, on the one hand, adequate performance requires the ability of various competencies, on the other hand, it needs the learner’s willingness to make use of the learned competencies, and a certain degree of self-confidence

[18]. Thus, there is a gap between achieving a certain competence and the performance in a “real-life” setting. For this reason, currently, scholars advocate for a learners’ assessment that focuses on direct observation of performance, rather than assessment only based on competency [23].

Nevertheless, assessing competencies should include all four levels of Miller’s pyramid [24]. At the first level (“know”), the reproduction of learned knowledge is measured, most commonly through multiple-choice tests [24, 25]. These can also be used to assess the transfer of knowledge i.e., solving complex problems, which corresponds to the second level of the pyramid (“knows how”). Simulations, for instance physical examination on standardized patients, such as Objective Structured Clinical Examination (OSCE), tests the application of acquired knowledge and skills on the third level (“shows how”) [25, 26]. The top level (“does”) can only be examined in real clinical practice and is mostly carried out through subjective observations by clinical supervisors [24]. Here, the performance of learners is measured: they are assessed on their ability to apply a *bundle* of competencies in different clinical situations and contexts, rather than on knowledge, skills, and attitudes separately [18, 22, 23].

With the aim to provide an appropriate framework to observe, measure and evaluate clinical practice, Ten Cate introduced the concept of Entrustable Professional Activity (EPA) in 2005 [20]. After implementation in postgraduate medical education, teaching based on EPA is increasingly used in undergraduate education and it gained popularity in other health professions, such as pharmacy, dentistry, and veterinary medicine, as well as for medical assistants, nurses, physiotherapists, and dieticians [23, 27]. An EPA is a task of professional practice that can be entirely entrusted to learners, as soon as they are competent [23]. In this concept, the supervisor adjusts the intensity of supervision depending on the improvement of competence the individual shows. The learner passes through different levels, starting with the observation of the task, resulting in the aim to manage the task unsupervised and, in a later stage, to supervise others [28]. This can be summarized in five levels of supervision [29, 30]:

- 1) observation only;
- 2) performance under direct supervision;
- 3) performance under indirect supervision;
- 4) independent performance;
- 5) supervise others.

According to the Association for Medical Education in Europe (AMEE) Guide an EPA should fulfill following features. It has to be specific, delimited from other EPAs, and essential for the profession; it requires knowledge, skills and attitudes (involving one or more required competencies), and it must lead to a recognized output; it has to be executed independently by qualified personnel within a clearly defined time frame; it needs to be readily observable and measurable; finally, the title should describe a task itself, not the required competencies [23]. Since EPA serves as an operator of CBME, all competencies should be able to be linked to a professional activity. If a learning objective does not provide this, it shouldn’t be designated as a competency [20]. Furthermore, each derived professional activity should encompass a true contribution to health care, i.e., there shouldn’t be a need to review the learners work but it should rather serve directly for e.g., clinical decisions [23].

The trust, which is the basis for entrustment decisions through the supervisor has to be *grounded*, i.e. it should include all facets of trust resulting from repeated interactions [22]. Primarily, the entrustment decision depends on the learner’s trustworthiness, which includes general behaviors, such as conscientiousness, truthfulness, and help-seeking, as well as specific characteristics, such as knowledge and skills directly related to the task [28].

Additionally, an entrustment decision must also result from day-to-day observations leading to ad hoc entrustment and structural trust [22, 30]. Ad hoc entrustment decisions happen every day in clinical practice (e.g., critical problems entrusted to a resident when the resident calls the senior physician on the nightshift) while structural entrustment decisions are made as soon as a trainee has exceeded a threshold that permits a lower level of supervision or at the end of a learning unit referring to the *summative trust* which has arisen over the time of the observation. At this point, the learner can obtain a so called “statement of awarded responsibility” (START) certificate, which proofs his acquired competence and the decrease of needed supervision formally [30]. Although every entrustment decision is subjective and depends from the supervisor and his relationship to the trainee, it is still a valid tool as it reflects the real outcome of the training and the quality of care delivery through the trainee [18].

Using EPA in CBME has numerous potential benefits.

- First, for the reasons outlined above, its use has the potential to overcome the mismatch that was found between expected and observed performance [27].
- Second, the assessment of competencies using EPAs decreases bureaucracy and focuses on the real outcomes that should be measured, as it is often easier to observe, measure and assess a professional activity than an achievement of competencies [18, 21].
- Third, a fully implemented EPA helps to clearly define, for which tasks the individual is ready, permitted and entitled, and how much supervision is needed, so personnel know exactly what can be entrusted to the trainee.
- Fourth, in the same way this also serves the trainee to compare his current level of supervision with his own expectations and provides the learner an opportunity to self-assess and create own goals [23, 27].
- Fifth, the improvement of education and assessment through clear requirements and learner-centeredness provides the possibility of developing individual concepts, if there is a gap between expected and observed performance, making education individual and flexible. Thereby, also qualitative reflections form an important part of EPA’s assessment [27].
- Sixth, the trainees are given autonomy while being supervised. In this way, they can “progress from their current level of competence (what they can do) to demonstrating their capability (what they are able to do but have not yet done)” [28].
- Lastly, apart from education and assessment related benefits, EPA offers also a potential tool to research on medical education, students’ performance and the medical curriculum [27].

### **Aims and objectives**

The aim of the study is the implementation and the explorative evaluation of a competency-based training session teaching practice nurses in the use of phase-contrast microscopy on fresh urine.

We are interested in the following outcomes:

- 1) How great was the learning gain on each step of Millers pyramid?
- 2) What are the practice nurses’ attitudes towards learning? And how changed this attitude over time?
- 3) How do the practice nurses assess themselves?
- 4) How do they handle their new competence in practice?

- 5) Which were their experiences of participating in the program?
- 6) How do they describe their performance of the new task?
- 7) How useful do general practitioners perceive the introduction of an EPA for new practice nurse competencies?
- 8) What difficulties and feelings do general practitioners have concerning the entrustment to practice nurses?

## Methods.

### Intervention

The intervention is a competency-based teaching session for practice nurses to teach them how to rapidly perform phase-contrast microscopy on fresh urines. Furthermore, practice nurses will be taught on the correct application of the treatment algorithm based on the results of the microscopy and dipstick analyses, as well as on some basic knowledge about uncomplicated urinary tract infections. Further information about the content of the course is listed in table 1. The learning goals are shown in table 2.

<b>Inhalt der Schulung (table 1)</b>	
<b>Thema</b>	<b>Behandelte Punkte</b>
Was ist eine Harnwegsinfektion (HWI)?	Definition der HWI
Typische Erreger einer Harnwegsinfektion (HWI)	Stäbchenförmige Bakterien
	Kokkenförmige Bakterien
Pathogenese der unkomplizierten HWI	Anatomische Prädisposition der Frau
Formen der HWI	Obere und untere HWI
	Komplizierte und unkomplizierte HWI
	Rezidivierende HWI
	In Abgrenzung: Asymptomatische Bakteriurie
Typische Symptome einer HWI	Symptomatik einer unkomplizierten HWI
	Symptomatik einer Pyelonephritis
Die komplizierte Harnwegsinfektion	Komplizierende Faktoren
Diagnostik der unkomplizierten HWI gemäß der Leitlinie der Deutschen Gesellschaft für Allgemeinmedizin und Familienmedizin (DEGAM)	Anamnese
	Urinstreifentest auf Leukozyten Esterase und Nitrit
	Urinkultur (begrenzte Indikation)
Therapie der unkomplizierten HWI	Vor- und Nachteile einer Antibiotikatherapie
	Vor- und Nachteile der symptomatischen Therapie
	Erstwahl Antibiotika
Rezidivprophylaxe	Verhaltensänderungen
	Pflanzliche Prophylaxen
Grenzen der Diagnostik gemäß DEGAM Leitlinie	Hoher Anteil tatsächlich nicht Infizierter unter den symptomatischen Patientinnen
	Fehlen einer praktikablen Methode, um HWI auszuschließen
MicUTI Studie	Ziel der Studie
	MicUTI- Behandlungsalgorithmus
Urinstreifentest	Durchführung
	Auswertung (Erythrozyten, Nitrit, Leukozyten Esterase)
Phasen-Kontrast Mikroskopie von Frischurin	Handhabung des Phasen-Kontrast Mikroskops

	Bildanalyse (Morphologie, Quantität, Abgrenzung von Bakterien zu menschlichen Zellen)
MicUTI-Behandlungsalgorithmus	Hämaturie und Bakteriurie Erarbeitung eines Behandlungsvorschlags

<b>Lernziele (table 2)</b>	
Die unkomplizierte Harnwegsinfektion (HWI) der Frau	
<u>Lernziel 1</u>	<i>Die Teilnehmer*innen sollen unter Patientinnen mögliche Studienteilnehmerinnen identifizieren, indem sie das Erscheinungsbild einer Harnwegsinfektion und die komplizierenden Faktoren als Ausschlusskriterien kennen.</i>
Teillernziele	Nennen der Definition der Harnwegsinfektion
	Darstellen der Merkmale einer komplizierten HWI, indem sie die komplizierenden Faktoren einer HWI beschreiben
	Angaben der typischen Symptome, die Patientinnen mit einer unkomplizierten HWI zeigen
<u>Lernziel 2</u>	<i>Die Teilnehmer*innen können als Expert:in zum Thema HWI Patientinnenfragen beantworten und so die Studienpatientinnen im Team mit der Ärztin/ dem Arzt betreuen.</i>
Teillernziele	Beschreiben der Pathogenese einer HWI
	Nennen der Behandlungsoptionen für Patientinnen mit unkomplizierter HWI
	Darstellen der Vor- und Nachteile einer Therapie mit Antibiotika
	Angaben möglicher Rezidivprophylaxen für Patientinnen mit häufigen HWI
Auswertung von Frischurinproben mittels Urinteststreifen und Phasen-Kontrast Mikroskopie und Anwendung des MicUTI-Behandlungsalgorithmus unter Einbezug der Ergebnisse	
<u>Lernziel 3</u>	<i>Die Teilnehmer*innen sollen Frischurinproben mittels Urinteststreifen und Phasen-Kontrast Mikroskopie auswerten.</i>
Teillernziele	Standardisiertes Durchführen eines Urinstreifentests
	Auswerten des Urinstreifentests auf das Vorhandensein von Nitrit, Leukozyten-Esterase und Erythrozyten
	Bedienen des Phasen-Kontrast Mikroskops, indem die Schritte (Einschalten des Mikroskops, Einstellen der notwendigen Vergrößerung, kombinieren des Objektivs mit dem richtigen Phasen-Ring im Kondensator, Probenpipettierung, und Auflegen des Objektträgers) bis zum Erhalt eines Bildes richtig durchgeführt werden
	Erkennen, ob Bakterien im Urin auffindbar sind
	Erkennen, ob es sich um Bakterien oder menschliche Zellen handelt, indem die Größenverhältnisse beschreiben und richtig eingeordnet werden
	Abschätzen der Quantität des Bakterienaufkommens, indem die Bakterienanzahl in 3 unterschiedlichen Kästchen des Objektträgers den Gruppen keine, niedrige, mittlere und hohe Bakterienkonzentration zugeteilt werden



Lernziel 4	<i>Die Teilnehmer*innen sollen den MicUTI-Behandlungsalgorithmus auf die Ergebnisse aus Mikroskopie und Urinteststreifen anwenden.</i>
Teillernziele	Zusammentragen der Ergebnisse über Bakteriurie und Hämaturie aus Mikroskopie und Urinteststreifen
	Erarbeiten eines Behandlungsvorschlags für den Arzt/die Ärztin, indem die Empfehlung über eine Antibiotikatherapie im Algorithmus abgelesen wird

The evaluation of the teaching session is composed of two parts, a quantitative and qualitative. Questionnaires, practical tests, and interviews will provide insights into the competence gain, task performance and the perspectives associated with the experience of the medical assistants.

#### *Quantitative evaluation*

The quantitative part of the study includes a questionnaire to collect data on knowledge, attitude, and self-assessment before and after the teaching session and a practical test to assess the skills of each practice nurse.

Both the questionnaire and the practical test will be repeated. Additionally, practice nurses evaluate the training session using a short questionnaire.

#### Evaluation through a questionnaire

The acquisition of knowledge, attitude and self-assessment through the questionnaire will occur before, directly after, and three months after the teaching session. All questionnaires can be found in the appendix.

#### Evaluation through a practical tests

The practical test will occur directly after, and three months after the teaching session with the aim to measure the acquisition and retention of competence. Each participating practice nurse has to analyze 6 urine samples with standardized uropathogenic bacteria. The standardized strains provided by the Institute of Microbiology of the University of Wuerzburg are identical for all practice nurses and include different concentrations of the relevant uropathogenic bacteria as defined by current guidelines, namely *Escherichia coli*, *Proteus mirabilis*, *Staphylococcus saprophyticus*, and *Klebsiella pneumoniae*. Additionally, some of the urines contain Erythrocytes [1].

The test is conducted directly after the training session and at a 3-months follow-up. When the samples are brought to the practice, practice nurses must analyze them during their working time to simulate a situation as close to real practice as possible. Each sample must be examined with a phase-contrast microscope to detect bacteria and a dipstick test to proof the hematuria. Microscopes and dipsticks are provided from the University of Wuerzburg.

To verify the correct examination of the samples, the practice nurses will fill a short questionnaire. There they have to declare which of the samples contain bacteria and which are positive for hematuria. Furthermore, they must decide for each sample whether or not to suggest antibiotic treatment.

Their results are compared with the known concentrations of each sample.

### Planned analyses

The evaluation of the quantitative variables will be descriptive. As the nature of the study is explorative, no formal hypothesis-testing is planned.

### *Qualitative evaluation*

For the qualitative part we conduct semi-structured interviews based on the Consolidated Framework for Implementation Research (CFIR). They are held with the practice nurses to find out, how they experienced the training session, how they handle their new competence and how they describe their performance of the new task. In cooperation with the University of Munich we also interview the general practitioners of each practice via telephone. From them we aim to understand the experiences the practice teams have had with the introduction of the EPA for new practice nurse competencies, if they experienced any problems concerning the entrustment decisions and how they felt giving the practice nurses new responsibilities.

### **Study Population and Recruitment**

The MicUTI trial, in the context of which this study is conducted, is carried out in a primary care research network based in the German Federal State of Bavaria, the Bavarian Practice Based Research Network ([BayFoNet](#)). Three out of the five university departments of general practice/family medicine part of the BayFoNet are involved in MicUTI and recruit 20 general practices located in the Federal State of Bavaria (Wuerzburg and Erlangen, and surrounding areas) to be randomly allocated to the intervention (UTI management based on PoC-tests) or to the control arm (usual care).

The population for this study are practice nurses of the general practices randomized to the intervention group of the MicUTI trial. Each of these practices will provide 1-3 practice nurses available to perform the microscopy. Additionally, general practitioners of the intervention group form the second part of the study population, as we will interview them as well qualitatively.

### **Discussion**

#### *Professional training of practice nurses in Germany*

After a three-year professional training in Germany, medical assistants mainly work in medical practices of all specialties, in hospitals, or in company medical departments. There, they assist physicians in the examination, treatment, care, and counseling of patients and perform organizational and administrative work. This includes allocating appointments to patients, documenting treatment procedures for patient records, billing for health deliveries, organizing the practice workflow, and performing medical procedures, such as wound dressings, injections, or taking blood or urine samples for laboratory tests. They also provide patients with information about care options, maintain medical instruments, and perform laboratory work [31]. After their (non-academic) graduation, medical assistants can sub-specialize, but the opportunities for further formal training are limited [32]. In addition, there is still a lack of official recognition and clarification on financial compensation for medical assistants acquiring additional qualifications [33].

The Implementation of an EPA for practice nurses in general practice within the framework of a clinical randomised trial is a novelty in Germany. This study could serve as a model for future

training in this sector. Moreover, it aims to get an insight to the attitudes and experiences of practice nurses towards further training and the acquisition of new qualifications.

### Limitations

As stated above, assessment of learning gain in competency-based education should include all four levels of Miller’s Pyramid. In this study, the practice nurses are assessed only through a multiple-choice and a simulated practical test. This indicates that their competence is not measured on the last step of Miller’s Pyramid “does”, which can only be assessed in real clinical practice. This distinction is particularly important in cases, where simulations and clinical practice differs a lot. In our situation, where a patient’s urine sample and the urine samples provided from the Institute of Microbiology of the University of Wuerzburg does not differ in appearance, we consider the simulation to be sufficient to assess performance. Also, the practice nurses perform the practical test during their working time to simulate a situation as close to real practice as possible.

As the expected number of participating practice nurses is limited (n= min. 10, max. 30), the quantitative evaluation of the training session is explorative and will be based on purely descriptive analyses. Selection bias is possible due to the small sample size and the non-random recruitment of participants. Therefore, the quantitative evaluation will not allow any general conclusion about the effectiveness of the training session nor practice nurses' ability of gaining competence in general. For these reasons, rather than aiming to give definitive answers to the question of the intervention’s effectiveness, this study aims to gain in depth insights on the implementation of a competence-based approach addressed to general practice nurses, a widely understudied population, with a mix of quantitative and qualitative methods.

### Schedule

An overview of the schedule is provided in the table below:

Arbeitsschritte der Studie	Aufgaben	2022												2023									
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10
Vorbereitung	Literaturstudium	■	■	■	■																		
	Expose Schreiben	■	■	■	■	■																	
	Ethikkurzantrag Einreichen						■																
	Erstellen von Fragebögen						■	■	■	■	■	■											
	Planung des praktischen Tests						■	■															
	Planung des Interviews								■	■	■	■	■										
	Planung des Schulungsinhalts								■	■	■	■	■										
Datenerhebung	Durchführung der Schulung und Fragebögen													■	■								
	Durchführung des praktischen Tests															■	■						
	Durchführung der Interviews																■	■					
Datenauswertung	Auswertung der Fragebögen															■	■	■					
	Auswertung des praktischen Tests															■	■		■				
	Transkribieren der Interviews																	■	■	■			
	Auswertung der Interviews																		■	■	■	■	
Publikation																					■	■	

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### Multiple-Choice Test

#### Wissenstest Harnwegsinfektionen, Phasen-Kontrastmikroskopie

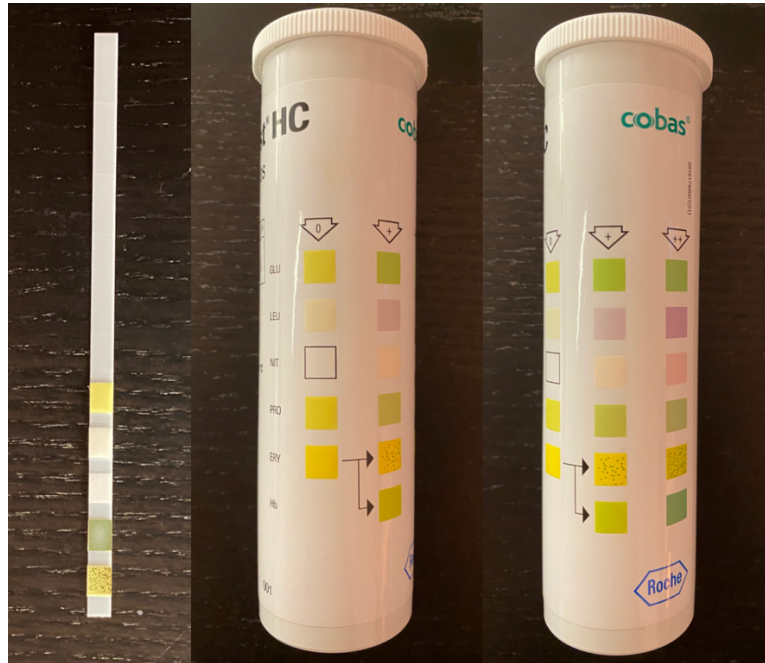
Bitte beantworten Sie alle der folgenden Wissensfragen. Wenn Sie sich nicht sicher sind, kreuzen Sie das an, was am Ehesten zutrifft. Es ist immer nur eine Antwort richtig.

1. Welcher Erreger ist in den meisten Fälle für eine unkomplizierte Harnwegsinfektion (HWI) verantwortlich?
  - Proteus mirabilis*
  - Escherichia coli***
  - Staphylococcus aureus*
  - Enterococcus faecalis*
  - Klebsiella pneumoniae*
  
2. Welcher Fall spricht hier am ehesten für eine unkomplizierte HWI, beinhaltet also keinen komplizierenden Faktor?
  - 64-jährige Frau mit rezidivierenden Harnwegsinfektionen (2-3x pro Jahr)**
  - 35-jährige Frau mit Diabetes mellitus
  - 42-jähriger Mann, sonst keine Erkrankungen
  - 85-jährige Frau mit Blasenkatheter
  - 58-jähriger Mann mit benigner Prostatahyperplasie
  
3. Welche Methode ist der Goldstandard zur Diagnostik einer unkomplizierten Harnwegsinfektion?
  - Phasen-Kontrast-Mikroskopie
  - Anamnese und Urinteststreifen
  - Lichtmikroskopie
  - Urinkultur**
  - Klinische Untersuchung
  
4. Was empfiehlt die Deutsche Gesellschaft für Allgemeinmedizin (DEGAM) zur Diagnostik einer unkomplizierten HWI in jedem Fall zu tun?
  - Phasen-Kontrast-Mikroskopie
  - Anamnese**
  - Anamnese und Urinteststreifen
  - Urinteststreifen
  - Urinkultur

5. Bei welchem der folgenden Symptome ist eine HWI *am wenigsten* wahrscheinlich?
- Schmerzen beim Wasserlassen
  - Urininkontinenz
  - Vaginaler Ausfluss**
  - gehäuftes nächtliches Wasserlassen
  - Fieber
6. Wie hoch ist ungefähr die Wahrscheinlichkeit für eine Harnwegsinfektion, wenn sich eine Frau mit den typischen Symptomen vorstellt?
- unter 50%
  - 60-70%**
  - 80-90%
  - über 90%
7. Welches ist kein typisches Anzeichen für eine Nierenbeckenentzündung (Pyelonephritis)?
- Flankenschmerz
  - Fieber
  - Klopfschmerzhaftes Nierenlager
  - Kopfschmerzen**
  - Übelkeit
8. Welches ist kein komplizierender Faktor für eine Harnwegsinfektion?
- Urininkontinenz**
  - Nierensteine
  - Immunsuppression
  - Urinkatheter
  - Antibiotikatherapie in den letzten 2 Wochen
9. Warum kommt die HWI bei Frauen häufiger vor als bei Männern?
- wegen der Nähe der Harnröhre zum Scheideneingang
  - wegen der Nähe der Harnröhre zum Anus**
  - weil Frauen typischerweise mehr frieren
  - weil Frauen menstruieren
  - weil Frauen durchschnittlich weniger trinken
10. Welcher der folgenden Parameter kann nicht mittels Urinteststreifen gemessen werden?
- Nitrit
  - Leukozyten Esterase
  - Bakterien**
  - Erythrozyten
  - Protein

## 11. Fallbeispiel

Im Rahmen eines Checkup-35 wird bei der Urinuntersuchung mittels Teststreifen einer 42-jährigen Patientin ohne schwere Vorerkrankung der im Bild gezeigte Befund erhoben.



1. Was lässt sich hier für die Patientin ablesen?
  - Bakteriurie
  - Diabetes mellitus
  - Hämaturie**
  - Proteinurie**
  - Akuter Harnwegsinfekt
2. Welche Befunde in ihrer Anamnese sprechen für eine unkomplizierte Harnwegsinfektion? (3 Antworten sind richtig)
  - Brennen beim Wasserlassen**
  - Schwangerschaft
  - frühere Harnwegsinfektionen**
  - allgemeines Krankheitsgefühl**
  - Nierensteine
3. Die Patientin gibt typische Beschwerden an, möchte aber gerne auf Antibiotika verzichten. Welche Antwort an die Patientin ist zutreffend?  
„Wenn Sie auf Antibiotika verzichten,...“
  - ...ist das Risiko für eine Nierenbeckenentzündung um das 15fache erhöht.“
  - ...erhöht sich das Risiko, dass die Keime resistent werden, und beim nächsten Mal der Infekt schwerer verläuft.“
  - ...vermindert sich das Risiko, dass resistente Keime entstehen.“**
  - ...soll der Urin für eine Woche täglich kontrolliert werden.“
  - ...ist eine Heilung nicht möglich.“



## Selbsteinschätzung

Inwiefern trauen Sie sich folgende Aufgaben zu? Hier gibt es kein richtig oder falsch.  
Versuchen Sie, so wahrheitsgemäß wie möglich zu antworten.

1. Ich traue mir zu, eine Hämaturie mittels Urinteststreifen zu erkennen.

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen

2. Ich traue mir zu, das Phasen-Kontrast Mikroskop richtig einzustellen, um ein gutes Bild zu erhalten.

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen

3. Ich traue mir zu, eine Bakteriurie mittels Phasen-Kontrast Mikroskop zu erkennen.

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen

4. Ich traue mir zu, die Menge der Bakterien im Urin mittels Phasen-Kontrast Mikroskopie den Kategorien niedriges, mittleres und hohes Bakterienaufkommen einzustufen

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen

5. Ich traue mir zu, in der Phasen-Kontrast Mikroskopie die Gestalt der Bakterien zu erkennen (Kokken in Ketten/Haufen oder Stäbchen)

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen

6. Ich traue mir zu, Erythrozyten von Bakterien im Phasen-Kontrast Mikroskop sicher zu unterscheiden.

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen

7. Ich traue mir zu, aus den Ergebnissen des Urinteststreifens und der Phasen-Kontrast Mikroskopie herzuleiten, ob eine Antibiotikatherapie laut Studienprotokoll indiziert ist.

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen

8. Ich traue mir zu, die Phasen-Kontrast Mikroskopie an Frischurin im Praxis-Alltag selbstständig durchzuführen.

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen

**9.** Ich traue mir zu, einem Kollegen/einer Kollegin die Phasen-Kontrast Mikroskopie beizubringen.

gar nicht       kaum       mittelmäßig       ziemlich       vollkommen

**10.** Ich traue mir zu, einem Kollegen/einer Kollegin mit Problemen bei der Durchführung der Mikroskopie zu helfen.

gar nicht       kaum       mittelmäßig       ziemlich       vollkommen

**11.** Ich traue mir zu, Patientinnen zu erkennen, die eine unkomplizierte HWI haben.

gar nicht       kaum       mittelmäßig       ziemlich       vollkommen

**12.** Ich traue mir zu Patientinnenfragen über HWI und deren Therapie zu beantworten.

gar nicht       kaum       mittelmäßig       ziemlich       vollkommen

**13.** Ich traue mir zu, HWI-Patientinnen im Team mit der Ärztin/dem Arzt zu betreuen.

gar nicht       kaum       mittelmäßig       ziemlich       vollkommen

## Motivation und Einstellungen

### Zu Fortbildungen im Allgemeinen

Bewerten Sie, inwiefern die folgenden Aussagen für Sie zutreffen.

Ich finde, es ist die Pflicht einer/eines MFA, sich weiterzubilden.

trifft

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen    ZU.

Neues Wissen zu erlernen, ist interessant.

trifft

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen    ZU.

Ich möchte mich stets weiterbilden, weil ich einen Beitrag für die Gesellschaft leisten möchte.

trifft

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen    ZU.

Ich investiere Zeit/Energie/Ressourcen, um mich weiterzubilden.

trifft

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen    ZU.

### Speziell zu dieser Schulung

Bewerten Sie, inwiefern die folgenden Aussagen für Sie zutreffen.

Die Diagnostik von Harnwegsinfektionen interessiert mich.

trifft

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen    ZU.

Dass ich an der Schulung teilnehmen soll, belastet mich.

trifft

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen    ZU.

Mikroskopieren mach mir Spaß, bzw. ich glaube, dass es mir Spaß machen wird.

trifft

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen    ZU.

Wenn ich an meine neuen Aufgaben denke, fühle ich mich unwohl.

trifft

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen    ZU.

Wenn ich an meine neuen Aufgaben denke, fühle ich mich voller Energie.

trifft

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen    ZU.

Mit der Mikroskopie des Urins trage ich eine große Verantwortung.

trifft

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen    ZU.

Es ist sehr wichtig, dass ich die Mikroskopie richtig durchführe, da  
Behandlungsentscheidungen davon abgeleitet werden.

trifft

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen    ZU.

Ich darf mir keinen Fehler bei der Auswertung erlauben.

trifft

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen    ZU.

Die Themen des Kurses (Harnwegsinfektionen, Phasen-contrast Mikroskopie) sind für  
meinen beruflichen Alltag relevant.

trifft

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen    ZU.

Diese Fortbildung könnte meine beruflichen Aussichten verbessern.

trifft

gar nicht     kaum     mittelmäßig     ziemlich     vollkommen    ZU.

## Evaluation

### 1. Der Inhalt der Veranstaltung war...:

viel zu knapp       hätte gerne mehr erfahren       genau richtig       etwas zu viel       hat mich überfordert

### 2. Die Dauer der Veranstaltung war...:

viel zu kurz       angemessen       viel zu lang

### 3. Ich fand das Thema wichtig.

gar nicht       kaum       mittelmäßig       ziemlich       sehr

### 4. Ich war mit dem Kurs zufrieden.

gar nicht       kaum       mittelmäßig       ziemlich       sehr

### 5. Die Theorie des Kurses war zu umfangreich.

gar nicht       kaum       mittelmäßig       ziemlich       sehr

### 6. Die Praktische Übung des Kurses war hilfreich.

gar nicht       kaum       mittelmäßig       ziemlich       sehr

### 7. Die Formulierung von Lernzielen ist hilfreich.

gar nicht       kaum       mittelmäßig       ziemlich       sehr

### 8. Das Heft zum Nachschlagen ist hilfreich.

gar nicht       kaum       mittelmäßig       ziemlich       sehr

### 9. Ich möchte mehr über Harnwegsinfektionen erfahren.

gar nicht       kaum       mittelmäßig       ziemlich       sehr

Welche Schulnote würden Sie der Lehrveranstaltung insgesamt geben?

sehr gut

gut

befriedigend

ausreichend

mangelhaft

ungenügend

Was hat Ihnen besonders gut gefallen?

Was hat Ihnen nicht gefallen?

Möchten Sie noch etwas ergänzen?