

# Knowledge and Compliance among Staff Nurses in Collecting Urine Culture from Patients on Indwelling Catheter in A Medical Ward

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## ABSTRACT

Urine specimens can easily be contaminated by microbes in the genital area, which often leads to false positive results and antibiotic over-prescriptions. This study aimed to evaluate nurses' knowledge and compliance regarding urine collection with an indwelling catheter in a medical ward. A total of 101 registered nurses participated in this study from September 2020 to January 2021 at the *Hospital Raja Perempuan Zainab II (HRPZII)*. A total of 118 nurses participated in this study. Generally, the nurses had sufficient knowledge of the correct urine specimen handling. Cramer's V analysis showed a moderate association between hand hygiene knowledge and practice among the nurses ( $\phi_c: 0.273, p = 0.046$ ). In addition, the knowledge and practice of decontaminating continuous bladder drainage areas displayed a relatively moderate association ( $p = 0.01$ ). While most nurses showed knowledge of the contamination preventive measures, initiatives should be taken so that all nurses would be more likely to comply with the recommended procedure and reduce specimen contamination.

**Keywords:** *Urine Culture; Indwelling Catheter; Medical Ward; Nursing*

## INTRODUCTION

School children health is very important in the public health landscape. School health program was a crucial element of entire health. Urinary Tract Infection (UTI) is deemed the most common infection, accounting for millions of patient visits to the emergency department every year (Lough *et al.*, 2019; Ozer *et al.*, 2021). The most common nosocomial infection is catheter-associated UTI (CAUTI), with over a million cases in hospital and nursing home patients every year (Pepe *et al.*, 2020). The risk of contracting CAUTI increases exponentially with the increase in catheterization duration (Letica-Kriegel *et al.*, 2019).

Many healthcare providers do not follow current guidelines for the diagnosis and treatment of catheter-associated urinary tract infections (CAUTIs) (Sloane *et al.*, 2017). To confirm the indications of CAUTI, urine culture and sensitivity (C&S) is ordered. Unfortunately, some healthcare providers started antibiotic treatment even before the results are obtained (Sloane *et al.*, 2016). Doing so alongside collecting urine without following the correct procedure would lead to overdiagnosis and overtreatment of CAUTIs and unnecessary antibiotic use (Goebel *et al.*, 2021).

Urine C&S is a test performed to detect pathogens in the urinary tract. The specimens are tested for microscopy and antibiotic sensitivity (Prasada *et al.*, 2019; MOH, 2019). Consequently, the accuracy of UTI treatment is guided by the accuracy of urine C&S test results. Henceforth, specimens submitted for microbiological testing require proper handling from the time of collection through all stages of transport, storage, and processing to prevent contamination (Lough *et al.*, 2019).

Urine collection should be done before antibiotic treatment commences (Monegro *et al.*, 2022). It should not be collected from a drainage bag tap for fear of contamination (Brekke, 2019). Specimens should be sent for processing within an hour or kept in a fridge for 24 hours (National Health Service, 2019). If needed, preservatives are added to the specimens (Holm & Aabenhus, 2016). In addition, specimens should be taken according to the recommended number, as obtainment of more than the required specimen number does not improve result interpretation (Xiang *et al.*, 2021).

Although most guidelines for specimen handling remain unchanged, a recent emphasis has been placed on modifying traditional practises to decrease or eliminate

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unnecessary work, increase laboratory efficiency, and make microbiological testing more cost-effective (Kim *et al.*, 2019; Mueller *et al.*, 2017). When proper procedures are followed, result interpretation becomes easier, reduces unnecessary work, and as documented for some specimens, reduces health care costs.

## METHODOLOGY

This study used a quantitative cross-sectional design from September 2020 to January 2021.

The study was conducted in the medical unit at the *Hospital Raja Perempuan Zainab II (HRPZII)*, which comprises 8 wards: Ward Mahsuri, Ward Puteri, Ward Bendahara, Ward Temenggong, Ward 08, Ward 09, cardiac rehabilitation ward, and the critical care unit.

A purposive sampling technique was used with inclusion and exclusion criteria.

### Inclusion Criteria:

All registered nurses (grade U29 and grade U32) in the 8 selected wards are included in the study.

### Exclusion Criteria (Interventional group):

The exclusion criteria for the study are as follows:

- Staffs who were just rotating temporarily from that ward
- Other clinical staff nurses who were newly hired
- Staff nurses who were on leave

### Sample Size

A total number of 118 nurses in the Medical Unit was used. The determined known population was based on the Krejcie & Morgan, (1970) table of sample sizes.

### Data Collection Instruments

Data collection is divided into two parts: a) a bilingual questionnaire (Bahasa Malaysia and English) and b) a urine sampling checklist. The questionnaire was adapted from Elmi *et al.* (2019) and consists of sections A (demography) and B (knowledge) to identify nurses' knowledge levels. The second part involves a checklist for evaluating nurses' compliance with urine culture and sensitivity (C&S).

The questionnaire was self-administered, and there was no time limitation to answer the questions. The demographics collected in Section A include the level of education and working experience. Questions regarding knowledge of urine C&S with an indwelling catheter are in Section B. The questions in Section B revolve around hand hygiene, sampling techniques, and sample transportation and storage. All questions in both sections

are close-ended, and a three-point Likert scale was used to evaluate nurses' knowledge. The Likert scale represents; 1 - agree, 2 - disagree and 3 - not sure.

The participating nurses were observed when taking urine C&S samples and a checklist was used to evaluate how the nurses carried out the sampling procedure. The checklist constitutes equipment preparation, aseptic technique, and sample handling. A simple "Yes" or "No" answer was used. In addition to that, posters on the correct urine collection technique were distributed at the participating wards alongside continuous medical education on urine sampling from catheterized patients.

### Data Analysis

Before, proceeding with statistical analysis, a normality test was run using the Shapiro-Wilk test. The  $p$ -value exceeds 0.05, so the data shows a normal distribution. However, the data in this study showed values of  $p < 0.05$  for skewness and kurtosis. Hence, parametric tests were used.

All descriptive data are presented in the form of frequencies and percentages. Since all data collected are in form of categorical data, the exact test is used to find associations between the knowledge and compliance among nurses in proper urine sampling technique. The exact test is fit for analysis as more than 20% of expected frequencies have values of less than 5. On top of that, the strength of associations was analysed using Cramer's V analysis. The Cramer's V analysis evaluates association strengths between two categorical variables (Kim, 2017, 2019).

### Ethical Consideration

Prior to the commencement of the study, the Clinical Research Centre (CRC) office has given ethical approval to carry out the research. Later, permission to conduct this research was granted by the Head of the Medical Department and the HRPZII with the Malaysian Research Ethics Committee with a reference number of 111200619290L/1902 dated December 19<sup>th</sup>, 2021.

## RESULTS

Table 1 showed the demographic data of nurses. The demographics were recorded to understand nurses' backgrounds. Age, gender, religion, highest degree and working experiences were recorded. Majority of nurses were in age group of 31-40 ( $n = 53$ , 52.5%) and most nurses are female ( $n = 92$ , 91.1%). Muslims make up 93% ( $n = 94$ ) of the nurses followed by Christianity and Hinduism where both make up 3.0% ( $n = 3$ ) of total nurses. The nurses comprised of about 38%

of post-basic nurses and 37% diploma holders. Almost half of the nurses have worked for 6 to 10 years (n = 40, 39.6%) while 29 nurses (28.7%) have worked for 16 years and above.

**Table 1: Demographic Data of Nurse**

Demographics	n (%)
<b>Age</b>	
21-30	24 (23.8)
31-40	53 (52.5)
41-50	20 (19.8)
51-60	4 (3.9)
<b>Gender</b>	
Male	9 (8.9)
Female	92 (91.1)
<b>Religion</b>	
Islam	94 (93.0)
Christianity	3 (3.0)
Hinduism	3 (3.0)
Others	1(1.0)
<b>Highest Degree</b>	
Diploma	37 (36.6)
Advanced Diploma	2 (2.0)
Post Basic	38 (37.6)
Bachelor's Degree	21 (20.8)
Graduate Degree	3 (3.0)
<b>Working Experiences</b>	
<b>1 year -5 years</b>	11 (10.9)
<b>6 years - 10 years</b>	40 (39.6)
<b>11 years - 15 years</b>	21 (20.8)
<b>16 years and above</b>	29 (28.7)

**Knowledge in collecting urine culture**

There were 12 questions to test the knowledge of the nurses on urine culture and sensitivity sampling procedure (Table 2). For the first question, 97% of the nurses (n = 98) agreed that they must wash their hands before performing Urine C&S. However, there was one nurse (1.0%) who was not sure that handwashing is necessary before the procedure. The majority also agreed that sterile technique should be used for the procedure (n = 93, 92.1%). About 74% of the nurses disagreed on using disposable gloves to take the samples (n = 75, 74.3%) while about 19% agreed that disposable gloves can be used to sample urine C&S (n = 19, 18.8%). More than half the nurses agreed that it is easier to sample urine C&S by close method compared to open method (n = 82, 81.2%). Only 15% of the nurses agreed that urine C&S can be taken directly from CBD bags (n = 15, 14.9%) which is wrong, while about 80% of them disagreed (n = 78, 77.2%) and 8% of them were not sure (n = 8, 7.9%). When asked whether it is necessary to contaminate CBD tubes with 70% chlorohexidine in alcohol before sampling, almost all nurses agreed (n = 90, 89.1%), 9% of them disagreed (n = 9, 8.9%) and only

2% of them stated that they were not sure (n = 2, 2%). For Question 7, the majority said that CBD tube should not be clamped during sampling (n = 73, 72.3%) while 8 nurses were unsure of it (n = 8, 7.9%). Seventy-seven nurses agreed that sterile PPE (76.2%) should be used during sampling while 20 nurses disagreed (19.8%) and 4 were unsure (4.0%). For question 9, 56 nurses (55.4%) agreed that 2% chlorohexidine should be used to decontaminate the junction of Foley catheter while 33 nurses disagreed on the statement (32.7%). Most nurses disagreed that patient could sample their own urine (n = 86, 85.1%). On question 11, the nurses were asked whether samples should be sent within 1 hour to which 83 nurses (82.2%) responded that they should while 8 nurses thought that they should not (7.9%). About 80 nurses said that samples should not be kept in the fridge to be sent the next day (n = 78, 77.2%) while only 15 of them (14.9%) agreed that it is possible.

**Table 2: Knowledge in Collecting Urine Culture**

Factors	n (%)		
	Agree	Disagree	Not sure
1 Hand washing must be performed before procedure of urine C&S.	98 (97.0)	2 (2.0)	1 (1.0)
2 Urine C&S must be taken with sterile technique.	93 (92.1)	5 (5.0)	3 (3.0)
3 Urine C&S must be taken with disposable glove.	19 (18.8)	75 (74.3)	7 (6.9)
4 Taking urine C&S by close method is easier than open method.	82 (81.2)	9 (8.9)	10 (9.9)
5 Urine C&S can be taken directly from CBD bag.	15 (14.9)	78 (77.2)	8 (7.9)
6 CBD tube needs to be decontaminated with Chlorohexidine 70% in alcohol before taking urine culture.	90 (89.1)	9 (8.9)	2 (2.0)
7 CBD should not be clamp during collecting of urine culture.	20 (19.8)	73 (72.3)	8 (7.9)
8 PPE (sterile glove, gown & mask) must be used during collecting of urine culture.	77 (76.2)	20 (19.8)	4 (4.0)
9 Used of Chlorohexidine 2% in aqueous to decontamination junction of foley catheter.	56 (55.4)	33 (32.7)	12 (11.9)
10 Urine C&S can be taken by patients own who use catheter (CBD).	13 (12.9)	86 (85.1)	2 (2.0)
11 Specimen must be sent to laboratory in 1 hour after collection.	83 (82.2)	8 (7.9)	10 (9.9)
12 Urine C&S can be kept in the fridge before sent to laboratory in the next day.	15 (14.9)	78 (77.2)	8 (7.9)

**Compliance in collecting urine culture**

Compliance represents the checklist for the nurses to evaluate their practice on urine C&S sampling through observation. The checklist comprises of 12 elements. The first element examines equipment preparation. Only 1 nurse did not prepare the equipment (1.0%). Most nurses prepared sterile PPEs (n = 91, 90.1%), disposable dressing set (n = 90, 89.1%), 70% Chlorohexidine in alcohol (n = 87, 86.1%), urine container (n = 100, 99.0%), needle (n = 87, 86.1%), syringe (n = 99, 98.0%), procedure trolley (n = 97, 96.0%) and sharp bin (n = 90, 89.1%). On checklist number 2, most nurses (n = 71, 70.3%) performed hand hygiene and wear disposable

gloves. Ninety nurses (89.1%) clamped CBD between 3 inches from the bottom of the prick area for 30 minutes. On checklist number 4, 94 nurses (93.1%) performed hand hygiene and wear sterile gloves. Ninety-five nurses decontaminated area junction of the CBD using 70% chlorohexidine in alcohol. Eighty-eight nurses (87.1%) were observed to use sterile needle and syringe. A majority of 92 nurses (91.1%) aspirated 10 ml to 20 ml of urine samples. Ninety-nine nurses (98.0%) had placed urine sample into the urine container and close lid tightly and neatly as well as labelled and placed urine container into specimen plastic. After that, 95 nurses (94.1%) were observed to open the clamp on patient's CBD. The majority of nurses performed hand hygiene after the procedure (n = 99, 98.0%).

**Table 3: Compliance Checklist in Collecting Urine Culture Association between Knowledge and**

Variables		n (%)	
		Yes	No
1	Prepare equipment	100 (99)	1 (1.0)
	a) Personal Protective Equipment- sterile gloves, gown and surgical mask	91 (90.1)	10 (9.9)
	b) Disposable Dressing Set	90 (89.1)	11 (10.9)
	c) Chlorohexidine 70% in alcohol	87 (86.1)	14 (13.9)
	d) Urine container	100 (99.0)	1 (1.0)
	e) Needle	87 (86.1)	14 (13.9)
	f) Syringe	99 (98.0)	2 (2.0)
	g) Procedure trolley	97 (96.0)	4 (4.0)
	h) Sharp Bin	90 (89.1)	11 (10.9)
2	Perform Hand Hygiene and wear disposable glove	71 (70.3)	30 (29.7)
3	Clamp CBD between 3 inches from the bottom of the prick area for 30 minutes	90 (89.1)	11 (10.9)
4	Perform Hand Hygiene and wear sterile glove	94 (93.1)	7 (6.9)
5	Decontamination area junction of the CBD using Chlorohexidine 70% in alcohol	95 (94.1)	6 (5.9)
6	Prick area junction of CBD by using sterile needle and syringe	88 (87.1)	13 (12.9)
7	Aspirate 10ml to 20 ml of urine	92 (91.1)	9 (8.9)
8	Place urine sample into the urine container and close lid tightly and neatly	99 (98.0)	2 (2.0)
9	Label and place urine container into specimen plastic	99 (98.0)	2 (2.0)
10	Open the clamp on the patient's CBD	95 (94.1)	6 (5.9)
11	Perform Hand Hygiene	99 (98.0)	2 (2.0)
12	Send specimen in 1 hour after collection	89 (88.1)	12 (11.9)

**Association between Knowledge and Compliance**

Table 4 highlights the association between knowledge and compliance to urine collection procedures among nurses. There is a significant weak association between knowledge and compliance on aseptic technique involving hand hygiene and wearing disposable gloves

among nurses ( $\phi_c$ : 0.273,  $p = 0.046$ ). On the other hand, strong association can be seen between knowledge and practice on hand hygiene and sterile glove usage ( $\phi_c$ : 0.643,  $p = 0.001$ ). The nurses were aware and practiced decontamination at CBD area as moderate association were shown ( $\phi_c$ : 0.451,  $p = 0.010$ ). The questionnaire answer on hand hygiene performance after procedure corroborated with the checklist as there is moderate association portrayed ( $\phi_c$ : 0.502,  $p = 0.006$ ). There is a significant weak association on the knowledge and practice of disposable usage during sampling ( $\phi_c$ : 0.341,  $p = 0.003$ ). Next, the nurses agreed on the importance of sterile PPE usage and practiced the knowledge during procedure as there is moderate association indicated ( $\phi_c$ : 0.524,  $p = 0.001$ ). Lastly, since most nurses agreed and practiced sending urine specimen to the laboratory within an hour, moderate association is demonstrated ( $\phi_c$ : 0.421,  $p = 0.001$ ).

In general, there is no association between knowledge and compliance. Only handwashing had shown moderate strength of association between educational level and handwashing habits ( $\phi_c$ : 0.424,  $p = 0.034$ ).

**Table 4. Association Between Knowledge and Compliance**

Combinations	Theme	Cramer's V Value	p – value (Exact Test)	Association Strength
Question 1 & Checklist 2	Hand hygiene	0.178	0.235	-
Question 2 & Checklist 2	Sterile technique: Perform hand hygiene and wear disposable glove	0.273	0.046*	Weak
Question 2 & Checklist 3	Sterile technique: Clamp CBD area	0.252	0.058	-
Question 2 & Checklist 4	Sterile technique technique: perform hand hygiene and wear sterile glove	0.643	0.001*	Strong
Question 2 & Checklist 5	Sterile technique: Decontamination of CBD area	0.451	0.010*	Moderate
Question 2 & Checklist 6	Sterile technique: Use sterile needle & syringe	0.217	0.087	-
Question 2 & Checklist 8	Sterile technique: Place urine into container	0.394	0.061	-
Question 2 & Checklist 9	Sterile technique: Place into specimen plastic	0.394	0.061	-
Question 2 & Checklist 11	Sterile technique: Perform hand hygiene after procedure	0.502	0.006*	Moderate
Question 3 & Checklist 2	Use disposable glove	0.341	0.003*	Weak
Question 6 & Checklist 5	Use 2% Chlorhexidine in 70% alcohol	0.217	0.197	-
Question 7 & Checklist 3	CBD clamping	0.133	0.468	-
Question 8 & Checklist 1 (a)	Sterile PPE usage	0.524	0.001*	Moderate
Question 11 & Checklist 12	Send specimen in 1 hour	0.421	0.001*	Moderate
Question 12 & Checklist 12	Keep specimen in fridge within 24 hours	0.237	0.059	-

## DISCUSSION

Generally, most nurses in HRPZII portrayed that they are knowledgeable in the urine C&S procedure. Despite that, there are some nurses who showed that they did not practice according to their knowledge. The knowledge assessment showed that there are certain steps in the procedure that the nurses might have forgotten or were confused about (Letica-Kriegel *et al.*, 2019). Although there is a national guideline provided by the Ministry of Health, (2019) for clinicians to reduce contamination in urine culture samples, some clinicians may not be aware of it. Despite the weekly continuous medical education held at HRPZII, this study did not include the instrument to measure the number of training that each nurse underwent in the period of their career.

In this study, almost 80% of nurses showed that they understand the importance of wearing PPE during urine collection procedures (Perry *et al.*, 2019). This is incongruent with the nurses' practice, where almost all of them portrayed that they had prepared full PPE and equipment before sampling (Potter *et al.*, 2017). It is crucial to ensure both the patient's and nurse's safety during sampling. Donning PPE will ensure the safety of nurses during sampling.

Since the current study is done during the COVID-19 pandemic where PPE is paramount, nurses may have more positive attitudes (Gendeh, 2020). Evidently, a significant moderate association between their knowledge and practice of wearing PPE is displayed. Hand hygiene is listed in the Fundamental Principles of Infection Prevention in the Kementerian Kesihatan Malaysia (KKM) Policies & Prevention Control 2019, whereby healthcare workers should wash their hands often or use alcohol-based sanitizer to ensure clean hands. Proper sampling techniques, including handwashing, will minimise contaminants in samples (Ministry of Health, 2019).

Most nurses admitted that sampling from a catheter (closed system) is much more convenient than an open system (Dougherty & Lister, 2016). Unfortunately, some nurses in this study answered that it is okay to collect urine straight from the CBD bag (National Health Service, 2019). It is important to highlight that nurses should not sample urine directly from the drainage bag as there could be a multiplication of bacteria inside the bag even with the addition of an antimicrobial solution (Wang *et al.*, 2016).

## CONCLUSION

Most nurses showed good knowledge and compliance in urine C&S sampling. Significant associations can be seen between knowledge of and compliance with decontamination of the sampling area and the use of personal protective equipment during sample collection. Some insignificant associations can be seen in the knowledge and compliance, such as the decontamination of CBD (drainage) tubes with chlorhexidine in 70% alcohol before urine samples are collected, indicating that there were contradictions between their knowledge and how they actually comply with the urine sample collection.

## Conflict of Interest

The authors declare that they have no competing interests in writing this article.

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