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Nurses' Compliance with the Catheter Associated Urinary Tract Infection Prevention Bundle

Nur Annisha Karunia Latief, Ninuk Dian Kurniawati, Ika Nur Pratiwi

Abstract--- *Catheter-associated Urinary Tract Infection (CAUTI) was the fourth most common infection and results in increased morbidity, mortality, maintenance costs and length of stay. Prevention and Control of CAUTI were carried out by nurses through bundles. This study aimed to analyze the determinants of nurses' compliance behavior in the implementation of the CAUTI bundle with the Theory of Planned Behavior (TPB) approach. The study design was cross sectional study. A total of 111 nurses recruits with simple random sampling participated as the sample. Compliance with the implementation of the CAUTI bundle was the dependent variable whereas the independent variables were background factors, attitudes, subjective norms and intentions. The instrument used consisted of questionnaires. A logistic regression test (0.05) was used to determine the determinants of nurse compliance behavior. Educational background factors (p=0.039) and knowledge (p=0.014) was related to attitudes, knowledge (p=0.023) and work experience (p=0.020) related to subjective norms, attitudes (p=0.008) and subjective norms (p = 0.003) related to intention, and intention related to behavior (p=0.000) and had a value of r = 0.510 which means that the relationship between intention and behavior was quite strong. In conclusion, a factor that was directly related to the compliance in the implementation of the CAUTI bundle was the nurse's intention and the factors that were indirectly related were attitudes, subjective norms, and background factors (knowledge, education and length of work).*

Keywords--- *CAUTI bundle, Nursing, Theory of Planned Behavior, Determinant factors.*

I. INTRODUCTION

Modern health services are currently supported by a variety of invasive tools and action procedures that aim to provide care and speed up the recovery process of patients, but the use of these tools can cause an infection called an infection due to health services (HAIs.) Catheter Associated Urinal Tract Infection (CAUTI)) is one type of HAI that occurs due to the use of urine catheters [1]. Previous studies show that there are no explanations yet for several factors related to nurses' compliance behavior in implementing the CAUTI bundle. There is limited information about nurses 'compliance behavior in implementing the CAUTI bundle, and the background of nurses' compliance behavior in carrying out the CAUTI bundle has not yet been explained [2]. Research on determinants of nurse compliance behavior needs to be done to find out the most influential factors related to nurse compliance in implementing the CAUTI bundle and in an effort to control CAUTI.

[1]NHSN reports that CAUTI is the fourth most common infection in hospitals. In total, 15–25% of patients use a urine catheter and 75% of infections are due to a urine catheter [3]. According to INICC the CAUTI level is 5.3 per 1000 urine catheters and based on NHSN, the CAUTI level is 1.3 per 1000 urine catheters [4]. The number of CAUTI

Faculty of Nursing, Universitas Airlangga, Surabaya, Indonesia.

Corresponding author:
Dr. Ninuk Dian Kurniawati, S.Kep., Ns., MANP
Email: ninuk.dk@fkp.unair.ac.id

incidents in the United States in 2011 was 93,000 cases [5]. CAUTI cases at the Indonesian Hospital amounted to 114.75% caused by Escherichia Coli [6]. CAUTI suffered by patients, if not handled properly, can result in complications such as pyelonephritis, gram-negative bacteremia, septic arthritis, and meningitis. CAUTI also adds to the burden on patients because it causes discomfort, increased length of stay and increased costs and is even more severe, resulting in an estimated death of more than 13,000 deaths due to UTI annually [7].

This is supported by research by Al-Mousa et al. (2016) which shows that CAUTI causes an increase in length of stay to 19.2 days in adult and child ICUs and increases mortality by 11.1% in adult and child ICUs [8]. CAUTI can be prevented and controlled by the bundle. The CAUTI bundle is a series of interventions carried out to reduce infections due to urinary catheter placement [9]. Nurses must have behaviors that adhere to the implementation and application of the bundle as a form of CAUTI prevention and control.

Based on the Theory of Planned Behavior (TPB) the behavior displayed by individuals can be explained as arising because of the intention/intention to behave [10],[11]. This is the same as the behavior of nurses in the implementation of nursing actions, especially the implementation of the CAUTI bundle which is motivated by the intention of the nurses themselves so that the nurses make plans that are arranged in accordance with nursing interventions which will then be implemented among patients. This study aimed to analyze the determinants of nurses' compliance behavior in the implementation of the CAUTI bundle with the Theory of Planned Behavior (TPB) approach. Furthermore, it aimed to test the hypothesis of the study: the behavior of nurses in compliance performing the CAUTI bundle is directly related to intention. Intention is influenced by attitude factors and subjective norms. Intention is also approved by the background factors variable.

II. METHODS

The design of this study was cross sectional with the Theory of Planned Behavior used as the theoretical framework underpinning the study. Compliance with the implementation of the CAUTI bundle was the dependent variable whereas the independent variable consisteds of background factors, attitudes, subjective norms and intentions. The sample was determined using simple random sampling. A total of 111 nurses of Surabaya Hospital of Hajj who had attended the Basic Infection Prevention and Control (IPC) training and the CAUTI Bundle Quality Clinic Training were recruited as participants of the study.

The instruments used consisted of questionnaires about demographic data (age, education, length of work and career path), nurses' knowledge of the CAUTI bundle from the 2014 Warawirasmi with the value of the validity test results being 0.444 and the results for the reliability test being 0.963, TPB questionnaire from Ajzen in 2006 (attitudes, subjective norms and intentions) and the nurses' compliance behavior questionnaire in implementing the CAUTI bundle with the value of the validity test results being 0.704 and the results for the reliability test being 0.805.

Researchers provided information (informed consent) to all respondents with the aim of fulfilling formal and legal aspects. The research protocol was approved by the ethics committee of the Faculty of Nursing, Universitas Airlangga, Surabaya, number 1805-KEPK. Data collection was carried out with researchers giving questionnaires to respondents about background factors (age, education, knowledge, length of work, career path) followed by measurement of the main factors (attitudes, subjective norms) and intentions in implementing the CAUTI bundle. Then the researcher was accompanied by an Infection Prevention Control Nurse (IPCN) in conducting and filling out the observation sheets of the nurses' behavior without conveying the observation time to the nurses to validate the CAUTI bundle performed by nurses. Data were analyzed using a logistic regression analysis test with $\alpha = 0.05$ meaning H1 was accepted. Bivariate analysis ($p < 0.25$) was performed prior to the multivariate test. A Spearman rank test was used to see the relationship between intention and nurses' compliance behavior.

III. RESULTS

The results of this study include the background factors, comparison of background factors with attitudes and subjective norms, and comparison of attitudes and subjective norms with intention. The intention between relationship and nurses' compliance behavior in the implementation of the CAUTI Bundle.

Table 1. Frequency distribution of background factors (n = 111)

No	Variable	Frequency (n=111)	%
1	**Age**		
	1. 17-25 years	15	13.5
	2. 26-35 years	**48**	**43.2**
	3. 36-45 years	41	36.9
	4. 46-55 years	7	6.3
2	**Education**		
	1. RN with D3 in Nursing	81	73.0
	2. RN with D4 in Nursing	2	1.8
	3. RN with Bachelor of nursing with honor	**28**	**25.2**
3	**Knowledge**		
	1. Enough	18	16.2
	2. Well	**93**	**83.8**
4	**Work experience**		
	1. 1 – 3 years	25	22.5
	2. 4 – 7 years	12	10.8
	3. 8 – 13 years	**33**	**29.7**
	4. 14 – 20 years	24	21.6
	5. 21 – 27 years	17	15.3
5	**Career path**		
	1.Clinic Nurse I	24	21.6
	2.Clinic Nurse II	30	27.0
	3.Clinic Nurse III	**57**	**51.4**
	Total	111	100

RN: Registered Nurse, D3: Diploma three in nursing (three years), D4: Diploma four in nursing (four years of study)

As can be seen from Table 1, from 111 nurses, almost half of the them were aged 26-35 (43.2%), educated to Diploma three of Nursing (73.0%), had good knowledge (83.8%), had worked for 8-13 years (29.7%). Moreover, more than half of them were at Clinic Nurse III level in their career path (51.4%).

Table 2. Comparison of background factors with attitude (n = 111)

Variable *background factor*	Attitude				P-*value*
	Positive (n=73)	% (65.8)	Negative (n=38)	% (34.2)	
Age					
1. 17-25 years	6	5.4	9	8.1	0.131
2. 26-35 years	**32**	**28.8**	16	14.4	
3. 36-45 years	29	26.1	12	10.8	
4. 46-55 years	6	5.4	1	0.9	
Education					
1. Registered nurse (D3 Nursing)	**47**	**42.3**	34	30.6	0.039*
2. D4 Nursing	2	1.8	0	0	
3. Bachelor Science of nursing and Registered nurse	24	21.6	4	3.6	
Knowledge					
1. Enough	7	6.3	11	9.9	0.014*
2. Well	**66**	**59.5**	27	24.3	
Work experience					
1. 1 – 3 years	11	9.9	14	12.6	0.069
2. 4 – 7 years	5	4.5	7	6.3	
3. 8 – 13 years	**23**	**20.7**	10	9.0	
4. 14 – 20 years	20	18.0	4	3.6	
5. 21 – 27 years	14	12.6	3	2.7	
Career path					
1. Clinic Nurse I	10	9.0	14	12.6	0.619
2.Clinic Nurse II	18	16.2	12	10.8	
3.Clinic Nurse III	**45**	**40.5**	12	10.8	
Total	73	65.8	38	34.2	

*p<0.05 significant correlation

Statistical test results using logistic regression showed that educational background factors and knowledge have a significant relationship in determining the attitudes of nurses in the implementation of the CAUTI bundle ($p \leq 0.05$).

Table 3. Comparison of background factors with subjective norm (n = 111)

Variable *background factor*	Subjective norm				P-*value*
	Well (n=76)	% (68.5)	Moderate (n=35)	% (31.5)	
Age					
1. 17-25 years	8	7.2	7	6.3	
2. 26-35 years	**34**	**30.6**	14	12.6	0.070
3. 36-45 years	28	25.2	13	11.7	
4. 46-55 years	6	5.4	1	0.9	
Education					
1. Registered nurse (D3 Nursing)	**51**	**45.9**	30	27.0	0.152
2. D4 Nursing	2	1.8	0	0	
3. Bachelor Science of nursing and Registered nurse	23	20.7	5	4.5	
Knowledge					
1. Enough	8	7.2	10	9.0	0.023*
2. Well	**68**	**61.3**	25	22.5	
Work experience					
1. 1 – 3 years	13	11.7	12	10.8	0.020*
2. 4 – 7 years	6	5.4	6	5.4	
3. 8 – 13 years	**25**	**22.5**	8	7.2	
4. 14 – 20 years	17	15.3	7	6.3	
5. 21 – 27 years	15	13.5	2	1.8	
Career path					
1. Clinic Nurse I	12	10.8	12	10.8	0.710
2.Clinic Nurse II	21	18.9	9	8.1	
3.Clinic Nurse III	**43**	**38.7**	14	12.6	
Total	76	68.5	35	31.5	

*p<0.05 significant correlation

Knowledge background factors and length of work have a value of $p \leq 0.05$ so they have a significant relationship in determining the respondents' subjective norms in the implementation of the CAUTI bundle.

Table 4. Comparison of attitudes and subjective norms with intention (n = 111)

Variable	Intention				P-*value*
	Strong (n=86)	% (77.5)	Moderate (n=25)	% (22.5)	
Attitude					
1. Negative	15	13.5	23	20.7	0.008*
2. Positive	**71**	**64.0**	2	1.8	
Subjective norm					
1. Moderate	13	11.7	22	19.8	0.003*
2. Well	**73**	**65.8**	3	2.7	
Total	86	77.5	25	22.5	

*p<0.05 significant corrrelation

The logistic regression test shows attitudes and subjective norms have a value of p<0.05 so that subjective attitudes and norms have a significant relationship in determining the intention of respondents in the implementation of the CAUTI bundle. Meanwhile the perceived behavior control (PBC) has a value of p>0.05 which means there is no significant relationship in determining the intention of respondents.

Table 5. Correlation of intentions with nurses' compliance behavior in implementing the CAUTI Bundle (n = 111)

Variable	Compliance Behavior				P-*value*	r
	Compliant	%	Non compliant	%		
Intention						
1. Strong	**62**	**55.9**	24	21.6	0.000	0.510
2. Moderate	3	2.7	22	19.8		
Total	65	58.6	46	41.4		

The Spearman rank test results obtained a p value = 0.000, $p \leq 0.05$ which means there is a significant relationship between intention and compliance behavior in the implementation of the CAUTI bundle. The results of the relationship

strength test (rho) obtained a value of r = 0.510 which means that the relationship between intention and compliance behavior is strong enough and intention is directly proportional to behavior. The stronger the intention, the more obedient the behavior will be in implementing the CAUTI bundle.

IV. DISCUSSION

Correlation between background factor and attitude toward the implementation of the CAUTI bundle shows that education and knowledge background factors were proven to have a significant relationship with nurses' attitudes in implementing the CAUTI bundle [12]. Most nurses' knowledge was in the good category and influenced because nurses have been exposed to the CAUTI bundle through basic PPI training and CAUTI bundle quality clinical training, so it gives rise to a positive attitude response in the implementation of the CAUTI bundle.

This opinion was supported by the results of research conducted by Agustina, Mardiono, & Ibrahim (2016) on 31 nurses that investigated the relationship between the level of knowledge and attitudes of nurses in the implementation of the nursing round which showed a significant relationship between the level of knowledge with attitude with the value of p = 0.02[13]. The level of education related to nurses' attitudes can be explained by noting that a good educational background will influence nurses' attitudes to think and consider the risks and impacts that will occur in patients who have catheters not performed according to the CAUTI bundle. Ajzen (2006) in Nursalam (2016) states that one's educational background will affect one's work motivation and can increase intellectual maturity in making decisions and acting [14].

There was a correlation between background factor and subjective norms in the implementation of the CAUTI bundle. Knowledge background factors and working experience had a significant relationship with nurses' subjective norms in the implementation of the CAUTI bundle. Knowledge is a background factor related to normative belief and it affects one's subjective norms. The nurses in this study mostly had good subjective norms that influenced nurses' normative beliefs and motivation. The length of work is synonymous with the experience of working longer for someone who has an influence in increasing knowledge, normative beliefs and enhancing good relations that are harmoniously established with people around the work environment, because knowledge, normative beliefs and one's interaction relationships are also gained from experience [15]. This shows that the longer the work period, the better the normative beliefs and motivation to meet the expectations of others in the face of social pressure. Thus, the support and guidance from superiors or peers will provide normative confidence and motivation for nurses in implementing the CAUTI bundle.

Correlation between attitudes and subjective norms with the intention to implement the CAUTI bundle shows that subjective attitudes and norms have a significant relationship with nurses' intentions in the implementation of the CAUTI bundle because this intention is basically formed from determinants of attitudes and subjective norms. The intention of respondents to carry out the CAUTI bundle starts with the attitudes and norms of respondents' belief that these actions have benefits for patients who have a urine catheter installed in an effort to prevent and control CAUTI. The attitude towards the implementation of the installation of urine catheters and CAUTI bundles is a positive thing because it produces good benefits from the behavior. Subjective norms mean that nurses generally have confidence that minimizing the risk of CAUTI is a very necessary action, even the head of the room based on Standard Operating Procedures (SOP) also targets catheter care measures as a permanent procedure as well as the monitoring and evaluation of the PPI Committee targeting HAIs, especially CAUTI. Based on these norms, individuals are affected by it (refrent) so that it supports the intention to implement the CAUTI bundle and also leads to social pressure for the nurse if he/she does not implement it.

Correlation between intention and nurse's compliance behavior in the implementation of the CAUTI bundle show that intention has a significant relationship with the compliance behavior in the implementation of the CAUTI bundle.

This is because the majority of respondents have strong intentions which are influenced by positive attitudes and good subjective norms as the basis for the intention to implement the CAUTI bundle.

Compliance by nurses in carrying out the CAUTI bundle is marked by nurses always ensuring indications of urinary catheter placement, nurses maintaining a closed connection to the catheter, nurses ensuring the urine bag is under the bladder, and nurses not conducting bladder training using clamps. Meanwhile, the non-compliance that is often done by nurses in the implementation of the CAUTI bundle is that nurses install equipment without regard to aseptic principles with sterile tools, nurses perform fixation that is not in accordance with drainage, perineal hygiene is done only once a day and nurses do not recommend and offer education to family to do perineal hygiene.

This opinion is in line with Trihastutik's research (2018) conducted with 55 nurses who showed that subjective attitudes and norms had a significant relationship with nurses' behavior in managing non-pharmacological pain. Interventions for the installation and treatment of urine catheters or the implementation of the CAUTI bundle are very important for the prevention and control of CAUTI; this is in accordance with research by Fritsch, Sutton, Roche, Berberi, & Whidden (2019) which shows that compliance with the implementation of the CAUTI bundle in 2017 caused a 9.3% reduction in CAUTI and a 7.5% reduction in the length of the catheter installation.

Therefore it can be concluded that the compliance behavior of the implementation of the CAUTI bundle can be influenced by factors directly or indirectly. The factor that is directly related to the compliance behavior of the implementation of the CAUTI bundle is the intention of the nurse. While the factors that also indirectly affect the compliance behavior in the implementation of the CAUTI bundle are attitudes, subjective norms, background factors (knowledge, education and length of work).

This study has several limitations, namely not observing the compliance behavior in the implementation of the CAUTI Bundle directly with research respondents so that the CAUTI prevention item about aseptic installation with a sterile instrument was only measured by interviews conducted while each respondent was filling out a research questionnaire.

V. CONCLUSION

Compliance behavior in the implementation of the CAUTI bundle can be influenced by factors directly or indirectly. The factor that is directly related to the compliance behavior of the implementation of the CAUTI bundle is the intention of the nurse. While the factors that indirectly also affect compliance behavior in the implementation of the CAUTI bundle are attitudes, subjective norms, background factors (knowledge, education and length of work).

CONFLICT OF INTEREST

No conflict of interest.

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REFERENCES

[1] CDC, “Types of Healthcare-associated Infections,” 2014, [Online]. Available: https://www.cdc.gov/hai/infectiontypes.html.

[2] P. F. Fritsch, J. Sutton, E. Roche, V. Berberi, and E. Whidden, “Reinforcing a Catheter-Associated Urinary Tract Infection (CAUTI),” vol. 47, p. 2019, 2019.

[3] CDC, "Catheter-associated Infections (CAUTI) Urinary Tract," p. 2015, 2015, [Online]. Available: https://www.cdc.gov/hai/ca_uti/uti.html.

[4] E. Salgado Yepez *et al.*, "Device-associated infection rates, mortality, length of stay and bacterial resistance in intensive care units in Ecuador: International Nosocomial Infection Control Consortium's findings," *World J. Biol. Chem.*, vol. 8, no. 1, p. 95, 2017, doi: 10.4331/wjbc.v8.i1.95.

[5] S. S. Magill *et al.*, "Multistate Point-Prevalence Survey of Health Care–Associated Infections," vol. 118, no. 24, pp. 6072–6078, 2015, doi: 10.1002/cncr.27633.Percutaneous.

[6] E. M. Rosa, "Surveilence Incidences HAIs: Urinary Tract Infection (UTI), Surgical Site Infection (SSI) and Phlebitisat Hospital In Indonesia," vol. 04, no. 01, pp. 2147–2150, 2017.

[7] NHSN, "Patient Safety Component Manual," p. Chapter 9: Surgical Site Infection (SSI) Event, 2019, [Online]. Available: https://www.cdc.gov/nhsn/pdfs/pscmanual/pcsmanual_current.pdf.

[8] H. H. Al-Mousa *et al.*, "Device-associated infection rates, bacterial resistance, length of stay, and mortality in Kuwait: International Nosocomial Infection Consortium findings," *Am. J. Infect. Control*, vol. 44, no. 4, pp. 444–449, 2016, doi: 10.1016/j.ajic.2015.10.031.

[9] E. W. P. Sari, "Hubungan Barrier Nursing Dan Kateterisasi Urin Dengan Kejadian Infeksi Nosokomial Urinary Tract Infection Pada Pasien Terpasang Indwelling Kateter Tahun 2013 - 2014," vol. 2014, 2015.

[10] Ajzen, *Attitudes, Personality And Behavior second*., *Buckingham: Open University Press.* 2005.

[11] Nursalam, *Metodologi Penelitian Ilmu Keperawatan : Pendekatan Praktis Edisi 4*. 2016.

[12] C. W. Methu, C. M. Mwenda, and R. G. Mbugua, "Nurse Factors Influencing Compliance with CDC Guidelines for Catheter Associated Urinary Tract Infection Prevention in a Referral Hospital in Kenya," vol. 9, no. 3, pp. 70–76, 2019, doi: 10.5923/j.nursing.20190903.03.

[13] V. Agustina, Mardiono, and D. A. F. Ibrahim, "Hubungan Tingkat Pengetahuan dengan Sikap Perawat dalam Pelaksanaan Ronde Keperawatan di Ruang Aster dan ICCU RSUD dr. Doris Sylvanus," vol. 7, no. 1, 2016.

[14] T. Trihastutik, "Analisis Perilaku Perawat Dalam Pelaksanaan Manajemen Nyeri Non Farmakologi Pada Neonatus Yang Dilakukan Tindakan Invasif Minor Dengan Pendekatan Theory Of Planned Behavior (TPB)," 2018.

[15] G. Apriluana, L. Khairiyati, and R. Setyaningrum, "Hubungan Antara Usia, Jenis Kelamin, Lama Kerja, Pengetahuan, Sikap Dan Ketersediaan Alat Pelindung Diri (Apd) Dengan Perilaku Penggunaan Apd Pada Tenaga Kesehatan," *J. Publ. Kesehat. Masy. Indones.*, vol. 3, no. 3, pp. 82–87, 2016.