

## Development of A Catheter-Associated Urinary Tract Infection (CAUTI) Prevention Supervision Instrument Based on The CDC Guideline for Prevention of CAUTI

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### ABSTRACT

Catheter-Associated Urinary Tract Infection (CAUTI) remains one of the most common healthcare-associated infections and contributes significantly to increased morbidity, length of hospital stay, and healthcare costs. Suboptimal prevention practices and a lack of structured supervision instruments may lead to inconsistent adherence to evidence-based guidelines. This study aims to develop a supervision instrument for CAUTI prevention based on the CDC Guideline for Prevention of CAUTI. This study used a descriptive mixed-methods Research and Development (R&D) design, combining quantitative document analysis and qualitative interviews. A total of 100 patient monitoring documents were selected using purposive sampling, along with 7 ward head nurses as interview participants. Data were collected through document evaluation and semi-structured interviews, followed by Focus Group Discussion (FGD), expert consultation, and content validity testing using I-CVI. The developed instruments include a CAUTI prevention instrument for catheter insertion, as well as an instrument for prevention during catheter care and infection monitoring. The development encompassed the supervision format (including soft skills competency, interpretation), prevention content during catheter insertion, and prevention content during catheter care and infection monitoring. The validity test results for both instruments showed an I-CVI of 1.00, indicating that the instruments are valid and relevant. The developed instrument is expected to support the achievement of quality CAUTI prevention services in accordance with current guidelines, providing a comprehensive and high-quality instrument to enhance patient safety.

**Keywords:** Instrument; Supervision; Prevention; CAUTI; CDC

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### INTRODUCTION

Regulation of the Minister of Health of the Republic of Indonesia No. 30 of 2022 is a focal point in efforts to improve the quality of services in hospitals. This regulation, which focuses on improving service standards and patient care protocols. One key area where this regulation has proven effective is in simplifying processes and ensuring better compliance with healthcare standards. Effective monitoring mechanisms also need to be strengthened to ensure compliance with quality standards and continuous improvement in service quality (Adji, 2024).

Effective supervision can be implemented by paying attention to the content of supervision, structured, using standardized forms, documented and carried out by leaders, heads of rooms

or designated facilitators. Supervision can help improve practical skills, theoretical and technical abilities, and develop the personal and professional development of supervised nurses (Oktaviarini et al., 2023). Catheter-associated urinary tract infections (CAUTI) are one of the most common healthcare-associated infections (Waluyo et al., 2022).

The number of days of urinary catheter insertion from the Infection Prevention and Control Committee (PPI) data in 2023 and the first semester of 2024 at Universitas Airlangga Hospital was the second highest after peripheral intra-venous (IV), but the incidence of CAUTI was higher. Efforts to avoid catheter-related UTIs must be carried out and monitored by infection control guidelines in health institutions (Rubi et al., 2022). The implementation of CAUTI prevention in UNAIR Hospital shows that prevention efforts are still not optimal.

There are limited instruments to monitor CAUTI prevention in previous studies. A study implemented bedside visual reminders about CAUTI risk and a checklist to assess the need for catheters. Weekly adherence to the provided visual reminders and checklist was measured using a simple audit tool (Huong et al., 2020). Another study showed that implementation of an ICU rounding checklist reduced catheter-related urinary tract infections in ICU patients, making it a feasible and effective tool for reducing infections (Nassikas et al., 2020).

The role of nurses to prevent and control UTIs related to catheter insertion is an important part of patient safety (Sukarwan and Wardani, 2022). Implementation of appropriate measures and evaluation of risk factors are needed to reduce risk (Ling et al., 2023). Behavioral changes, including nurse empowerment and adherence to all elements of the care package, resulted in significant and sustained improvements in reducing CAUTI rates (Gupta et al., 2023). This requires supervision of practice and assessment of staff competence, availability of adequate equipment, documentation systems, adequately trained staff to support supervision, feedback and outcomes of urine catheter use, and surveillance (Ling et al., 2023). Assess and document compliance with IUC insertion and care guidelines using checklists ensuring adherence to proper procedural steps and identifying and addressing any deficiencies (Rosenthal et al., 2025). Complete and accurate checklists and documentation are required to effectively prevent and provide evidence of best practice in catheter management.

Despite the availability of CAUTI prevention guidelines, there is still a gap between recommended practices and their implementation in clinical settings. The absence of structured and standardized supervision instruments leads to inconsistent monitoring, incomplete documentation, and a lack of comprehensive evaluation of nursing practices. Therefore, developing a valid and comprehensive supervision instrument is essential to improve adherence to guidelines, strengthen supervision processes, and ultimately reduce the incidence of CAUTI.

## **METHODS**

### ***Study Design***

This study employed a descriptive mixed-methods design within a Research and Development (R&D) framework, combining quantitative document analysis and qualitative interview data to develop a CAUTI prevention supervision instrument.

### ***Setting***

The research conducted in February-June 2025 at Airlangga University Hospital Surabaya.

### ***Research Subject***

The document sampling technique used a purposive sampling method with a sample size of 100 documents, with inclusion criteria, namely, patient data installed with a urinary catheter as quantitative data. The interview sampling technique used a purposive sampling method with a sample size of 7 heads of ward/ intensive ward rooms, with inclusion criteria, namely the head of the room who was willing to participate in the study, as qualitative data.

### **Instruments**

The document evaluation sheet is used to assess whether the existing patient daily monitoring instruments are complete or not, based on the supervision structure and guidelines from the CDC. The results of the document evaluation will be used as a strategic issue to be discussed in the Focus Group Discussion (FGD). The second is a semi-structured interview guide consisting of questions on supervision practices, challenges, and needs for CAUTI prevention supervision. The interview guide was developed as a reference when conducting interviews with participants. The next are the FGD guide, expert consultation, and the validity test result.

### **Data Analysis**

Data analysis in this study employed both quantitative and qualitative approaches. Quantitative data obtained from document evaluation were analyzed using descriptive statistics to determine the frequency distribution and percentage of each supervision and CAUTI prevention component. Meanwhile, qualitative data from semi-structured interviews were analyzed using thematic analysis, including data reduction, coding, categorization, and theme identification to explore supervision practices and challenges. The results from both analyses were then integrated to formulate strategic issues, which served as the basis for instrument development through Focus Group Discussion (FGD) and expert consultation.

### **Ethical Consideration**

This study was approved by the Health Research Ethics Committee of the Airlangga Hospital under 022/KEP/2025. All research procedures adhered to ethical guidelines to protect participant rights and uphold scientific standards. Informed consent was obtained from all participants after providing detailed explanations of the study objectives and procedures. Confidentiality and voluntary participation were strictly maintained throughout the research procedure. Researchers ensure that research results have the added value required by the field and do not harm any part and equal treatment and no discrimination for each subject/participant.

## **RESULTS**

**Table 1.** Conformity of CAUTI supervision prevention component in patient daily monitoring documents

No	Assessment	Amount (%)	Remarks
<b>Supervision Component</b>			
1	Pra supervision	0%	Not Conform
2	Implementation of supervision	0%	Not Conform
3	Post-supervision	0%	Not Conform
<b>CAUTI Prevention Component</b>			
1	Catheter insertion	0%	Not Conform
2	Catheter care	28,57%	Not Conform
3	Monitoring for signs of CAUTI	85,71%	Conform

The results of the evaluation of the component of supervision of prevention compliance in daily monitoring of patients showed that 28.57% of catheter care was inappropriate and only 85.71% of CAUTI monitoring was appropriate.

**Table 2.** Evaluation of the completeness of filling out daily monitoring documents for patients with urinary catheters installed in January-December 2024 based on supervision elements

No	Supervision Element	Amount (%)	Remarks
1	Pra supervisiin	0%	Incomplete
2	Implementation of supervision	0%	Incomplete
3	Post supervision	0%	Incomplete

Table 2 showed that all documents evaluated were not filled in regarding the elements of supervision consisting of pre, implementation and post-supervision because all of them had not been applied in the daily patient monitoring document from the PPI Committee.

**Table 3.** Evaluation of daily monitoring documents of patients with urinary catheters installed from January to December 2024 based on the filling of prevention standards

No	Standart Aspect	Category		Total
		Complete	Incomplete	
1	<b>Urinary catheter insertion</b>			
	Knowledge of insertion indications	0 (0%)	100 (100%)	100
	Sterile equipment available	0 (0%)	100 (100%)	100
	Urine catheter insertion using aseptic technique	0 (0%)	100 (100%)	100
	Securing the position of the inserted catheter	0 (0%)	100 (100%)	100
	Closed drainage system	0 (0%)	100 (100%)	100
	Maintain smooth urine flow	0 (0%)	100 (100%)	100
	Education to the patient or family	0 (0%)	100 (100%)	100
	Conclusion	0 (0%)	100 (100%)	100
2	<b>Patient care</b>			
	Equipment for aseptic technique available	0 (0%)	100 (100%)	100
	<i>Periurethral hygiene</i>	73 (73%)	27 (27%)	100
	Closed drainage system	0 (0%)	100 (100%)	100
	Maintain smooth urine flow	0 (0%)	100 (100%)	100
	Monitoring for obstruction	0 (0%)	100 (100%)	100
	Specimen collection if needed	0 (0%)	100 (100%)	100
	Assess the need for urine catheter use	0 (0%)	100 (100%)	100
	Education for the patient or family	0 (0%)	100 (100%)	100
	Conclusion	6,64 %	93,36%	100
3	<b>Infection monitoring</b>			
	Day of insertion	73 (73%)	27 (27%)	100
	Signs/symptoms of CAUTI	0 (0%)	100 (100%)	100
	Positive germ culture and signs/symptoms of infection present	73 (73%)	27 (27%)	100
	Positive germ culture and no signs/symptoms of infection present	73 (73%)	27 (27%)	100
	Conclusion	36,50%	63,50%	100

This table shows the evaluation of the completeness of instrument filling from the time the patient had the urinary catheter installed until it was removed/moved to the unit. In the evaluation during catheter installation, 100% was incomplete, the completeness of initial instrument filling in catheter care was 6.64% assessed as incomplete, and the evaluation of infection monitoring was 36.50% assessed as incomplete.

From 100 daily patient monitoring documents from 2024, it was found that the existing instruments did not align with pre-supervision, supervision implementation (especially for catheter insertion), and post-supervision elements. CAUTI prevention content during catheter insertion was completely absent (0% conformity), while for catheter care, only 28.57% were compliant (only covering perineal hygiene). Monitoring for signs of CAUTI showed 85.71% conformity. The incompleteness of documentation was also very high, with 100% incomplete for catheter insertion, 93.36% incomplete for catheter care, and 63.50% incomplete for infection monitoring.

The characteristics of the interview subjects are as follows:

**Table 4.** Interview subject characteristics:

Age	Frekuensi (F)	Presentase (%)
26–35 years old	0	0%
36-45 years old	7	100 %
<b>Gender</b>		
Woman	5	71,43 %
Man	2	28,57 %
<b>Level of education</b>		
Nursing bachelor	3	42,86 %
Nursing magister	4	57,14 %
<b>Years of service</b>		
5-10 Years	0	0 %
>10 years	7	100 %
<b>Employee Status</b>		
Government employees	7	100 %
Permanenet employee	0	0 %

### Qualitative Findings

The results of interviews with 7 ward head nurses were analyzed using thematic analysis and generated several key themes related to supervision practices in CAUTI prevention:

#### 1. Absence of Specific CAUTI Supervision Instruments

Participants consistently reported that although general supervision forms were available, there were no specific instruments designed to monitor CAUTI prevention practices. This condition limited the ability of supervisors to evaluate compliance with CAUTI prevention standards comprehensively.

#### 2. Limited Scope of Supervision (Focus on Technical Skills Only)

Most participants stated that existing Standard Operating Procedures (SOPs) and supervision practices primarily focused on technical competencies. Soft skills such as communication and empathy were not included in the assessment, despite their importance in patient care.

#### 3. Inadequate Assessment System (Checklist Without Interpretation)

Participants highlighted that supervision instruments were predominantly checklist-based (yes/no), lacking qualitative assessment and standard interpretation. This made it difficult to measure the quality of nursing performance and determine appropriate follow-up actions.

The results of the validity test of the components of the CAUTI prevention supervision instrument development can be seen in the following table:

**Table 5.** Validity's test results

No	Instrument's name	Validity's test results (I-CVI)			Conclusion
		Expert 1	Expert 2	Expert 3	
1	CAUTI Supervision Form During Urinary Catheter Insertion	1	1	1	Valid
2	CAUTI Supervision Form During Urinary Catheter Infection Care and Monitoring	1	1	1	Valid

Content validity testing was conducted by 3 experts. The validity test results showed an I-CVI value of 1.00 for all question items in both instruments. This means that both developed instruments are valid and relevant for use.

## DISCUSSION

The evaluation results found that the patient's daily monitoring instrument did not have appropriate component and was incomplete in its filling. The biggest factor in this discrepancy and incompleteness is because the document being evaluated does not have a supervision flow, does not have a prevention component during CAUTI installation at all, and the prevention component during treatment is still minimal. Meanwhile, on the general supervision form, data was obtained that the form was generally available but had not been supplemented with content regarding supervision of CAUTI prevention. The availability of these two separate instruments means that supervision efforts cannot yet run optimally. Supervisory instruments have a close relationship with supervision because they are a barometer for supervisors (Asdlori, 2023). Structured supervision processes including the use of standardized supervision instruments can improve skills (Said & Islam Negeri Sultan aji Muhammad Idris Samarinda, 2025). Supervisory instruments are needed to ensure smooth implementation and quality education. Supervision helps management be more focused and can provide constructive feedback (Mariani et al., 2024). This instrument evaluation serves as a guide for researchers in determining the appropriate structure for the instrument. It is hoped that this instrument will be an effective tool for supervisors in monitoring and evaluating CAUTI prevention practices to ensure patient safety.

The latest supervision tools include CAUTI prevention tools during catheter insertion and CAUTI prevention tools during infection care and monitoring. These three key points represent actions nurses can implement daily. The new instrument based on the supervision format contains the instrument title, instructions, soft skill competencies and interpretation of the results.

The use of titles has been adjusted to the contents of the instrument to make it easier for supervisors. Developing supervisory instruments that are appropriate to the context will provide clear direction for supervisors and help supervisors make better decisions, thereby increasing the effectiveness and efficiency of supervision implementation (Mardiana et al., 2024). The success of supervision is largely determined by the quality of the instruments used, as well as systematic and accurate reporting of supervision results (Aufani et al., 2025). The new competency in this instrument is soft skills. Both hard and soft skills are crucial in the healthcare world, especially for medical personnel (Laari et al., 2022). Soft skills play an important role in professional life (Jamaludin et al., 2022). There are several types of soft skills that can be applied in an action, including communication, teamwork, empathy, leadership, decision-making and adaptability (Riawan et al., 2024). Empathy can improve communication between nurses and patients, play a role in building patient trust and helping patients feel understood and safe (Karaman et al., 2024). Communication and empathy are fundamental skills that nursing staff need to possess in providing nursing care. This new instrument makes it easier for supervisors to remember the soft skills assessment components and can provide a more comprehensive picture of the procedures performed by staff.

The new instrument also now has a result interpretation feature. The supervisory instrument serves as a tool to measure and monitor the quality of officer performance and identify areas for improvement (Akhoma Ummah et al., 2025). Without interpretation, data from supervisory instruments are only numbers or notes that are difficult to use for improvement (Carney et al., 2022). Supervisors no longer need to conclude assessments subjectively, making it easier to determine the capabilities of officers and the desired follow-up.

Further development is based on prevention components. The first prevention component is preventing CAUTI during catheter insertion. In addition to the components of the CDC Guidelines, researchers also added explanations to unclear sentences or provided examples of procedures. Additions include an antiseptic used to clean the periurethra before catheter placement. Chlorhexidine gluconate is one of the best methods for perineal care before catheter insertion (Elbaky et al., 2020). Chlorhexidine concentration of 0.5% - 4% is one

strategy to prevent UTI due to urinary catheters, and the most common use is using Chlorhexidine 2% (Rajab et al., 2024). For this reason, researchers took this antiseptic as the one of recommended ingredients. In addition, knowledge about installation indications is also included. Indwelling urinary catheters (IUCs) are commonly used in hospitalized patients, but often for inappropriate indications. Improper use of an IUC can cause CAUTI. Research from India and abroad indicates that knowledge of the appropriate indications for IUC use remains suboptimal among doctors and nurses (Susan & Deepanjali, 2022). Clear urinary catheter indication guidelines are effective in reducing the rate of CAUTI (Van Decker et al., 2021). CDC guidelines emphasize appropriate indications as a key component of CAUTI prevention. This means healthcare providers should always evaluate whether the benefits of catheterization outweigh the risks.

One of the key strategies in preventing CAUTIs is the principle of sterility during insertion. This strategy requires knowledge of how to maintain sterility and aseptic practices. (Balu et al., 2021). Previous studies found that only 67.4% of nurses used sterile techniques for insertion (Sohail et al., 2024). Routine validation of aseptic techniques for nurses is essential to ensure catheter insertion practices remain standardized and the risk of infection is minimized. A study showed that nurses' compliance in securing catheters after insertion was < 70% and was below acceptable levels (Al-Sayaghi et al., 2023). Lack of knowledge of nurses in securing urinary catheters can pose a risk to patients (Calpe-Damians et al., 2023). Effective catheter security significantly reduces the risk of UTI and meatal pressure injury in patients (Calpe-Damians et al., 2024). Monitoring catheter positioning is a critical yet often overlooked aspect of clinical practice. This neglect is not merely a minor oversight, but a problem that has the potential to lead to serious complications, increased patient morbidity, and even death.

The next instrument is prevention of UTI during treatment and monitoring of infection. This instrument has added monitoring of equipment, periurethral hygiene, monitoring of closed drainage systems, maintaining a smooth urine flow, ongoing needs assessment, monitoring of obstruction and education. A study found study showed that 79.3% of nurses did not perform catheter care every day (Sohail et al., 2024). Efforts to improve daily hygiene of the urethral meatus, by patients (if possible) or health workers, were found to be 0% (Paiva-Santos et al., 2023). Compliance with periurethral cleansing reduces the risk of UTI (Pandya et al., 2025). Compliance monitoring ensures that they not only understand the procedures, but also carry them out correctly. Obstruction monitoring and infection monitoring knowledge were also monitored. Monitoring infections in patients with urinary catheters is not simply a routine procedure. Without careful monitoring, early signs of a CAUTI, such as fever and suprapubic tenderness, can be missed, delaying intervention and worsening the prognosis. Effective monitoring can prevent or minimize the incidence of infection, ensuring patient comfort, faster recovery, and a more positive care experience.

Closed drainage system, maintaining smooth urine flow, and education is also included in the new instrument for monitoring. Disconnection of the catheter can increase the risk of bacterial contamination. Adherence to a closed drainage system reduces the risk of UTI (Pandya et al., 2025). Inadequate care can lead to catheter blockage, either by sediment, mucus, or blood clots. This blockage will interfere with urine drainage. Monitoring urine flow, and ensuring there are no kinks in the tubing or drainage bag are fundamental practices for maintaining optimal catheter function.

Education is carried out to fulfill comprehensive nursing care. Education by nurses will influence patient compliance in undergoing treatment, understanding of information and satisfaction with the services received by patients during treatment (Pratiwi et al., 2020). Strategies such as using accessible language, and integrating cultural considerations can enhance the impact of patient education on health outcomes (Fahad Alhassoon et al., 2022). Patients and families can become partners in care efforts with the right knowledge, which will ultimately improve patient clinical outcomes.

Instrument validity was assessed based on the I-CVI. The instrument validity test in this study was assessed by three experts. The test yielded scores of 3 and 4, which were then dichotomized to the I-CVI rule of 1.00. Validity for two instruments from three experts showed an I-CVI result of 1.00. If assessed by three to five experts, the instrument development is considered valid if the CVI = 1.0 (Yusoff, 2019). This result was obtained because the procedure was deemed still relevant to be carried out at the research site.

The CDC issued the Guideline for Prevention of CAUTI, a CDC-affiliated Healthcare Infection Control Practices Advisory Committee (HICPAC). Use of these CDC guidelines has shown effectiveness in reducing the duration of catheter use and possibly reducing the incidence of CAUTIs (Au et al., 2020). Other findings indicate that these guidelines are effective in significantly reducing the risk of catheter-related UTIs in hospitalized patients, contributing to reduced costs and length of hospital stay (Nasution et al., 2025). The CDC guidelines are based on scientific research and the best available evidence.

The recommendation from the development of this CAUTI prevention supervision instrument is that the instrument can be used to evaluate CAUTI prevention during catheter installation or maintenance. The emphasis of this instrument's recommendations is that a CAUTI prevention supervision instrument should be developed and used to monitor nurses' actions in providing care to patients with urinary catheters. This monitoring can be conducted in all units that perform urinary catheterization. CAUTI prevention during both insertion and care plays an equally important role. Although it is sometimes impossible to assess both within a single unit due to limited resources, supervision of insertion is still necessary to ensure nurses are implementing preventive procedures effectively.

## **IMPLICATION AND LIMITATIONS**

### **Implication**

This study provides a practical and evidence-based supervision instrument that can be used by hospital management to improve CAUTI prevention practices. The integration of technical and soft skill assessments allows for more comprehensive evaluation of nursing performance. Additionally, the instrument supports quality improvement programs and patient safety initiatives.

### **Limitations**

This study was conducted in a single setting, which may limit generalizability. The sample size for qualitative data was relatively small. Future research is recommended to test the effectiveness of the developed instrument in different hospital settings and evaluate its impact on CAUTI incidence.

## **CONCLUSION**

A CAUTI prevention supervision instrument document needs to be prepared to make it easier for supervisors to evaluate CAUTI prevention measures. The resulting instruments consist of two instruments: a supervision instrument for CAUTI prevention during urinary catheter insertion and a CAUTI prevention instrument for catheter care and infection monitoring. CAUTI prevention can be performed from the time of catheter insertion until removal. All units contributing to the prevention of CAUTI in the hospital can use this tool.

## **SUGGESTIONS**

This instrument can be integrated with existing regulations in hospitals, can be recommended for use during CAUTI prevention supervision, and for future researchers, they can conduct trials of this CAUTI prevention supervision instrument in relation to the ease of use of the instrument

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#### **DECLARATION CONFLICT OF INTEREST**

The authors declare that they have no conflicting interests

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#### **AUTHOR CONTRIBUTION**

All authors contributed significantly to all stages of the research. As a result, this study received more diverse considerations, resulting in more valid research data.

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