Development of a Preliminary Model to Prevent and Control Catheter-Associated Urinary Tract Infection: Thai Participatory Action Research

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Abstract: In this participatory action research the Model for the Prevention and Control of Catheter-associated Urinary Tract Infection was developed. This type of infection is one of the most common hospital acquired infections. A core working group of 14 people from three medical intensive care units in a tertiary care hospital in Thailand were empowered to develop this preliminary Model by collaborating with 26 nursing personnel and two physicians in the study settings. Data were collected using mixed methods: group discussions, in-depth interviews, facilitating group meetings and workshops.

The findings of this study included the following about the infection: inadequate knowledge, lack of awareness, ineffective communication and collaboration among the multidisciplinary team, and no continuous monitoring system about the practices of healthcare workers. The crucial components of the preliminary Model were: 1) updated evidence-based practice guidelines for prevention, 2) education training sessions, 3) a prevention campaign, 4) a sharing forum 5) practice monitoring, and 6) providing feedback and reinforcement.

The research findings demonstrated that using participatory action research focusing on multidisciplinary team involvement was effective in developing an appropriate preliminary model for catheter infection prevention and control that could be applied in a hospital setting. A future paper will describe the implementation of this Model, after which research is required to validate it in other settings and with other groups.

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Introduction

Catheter associated urinary tract infection (CAUTI) is a common hospital acquired infection (HAI) worldwide. In the United States, incidences of CAUTI were between 3.1 and 7.5 infections per 1,000 catheter-days.[1] Studies in intensive care units in developing countries found that CAUTI rates were 8.3 to 13.1 infections per 1,000 catheter-days.[2,3] Studies in 20 hospitals in Thailand found that the prevalence of nosocomial infection was highest in

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university hospitals, particularly in ICUs, and the incidence of CAUTI in tertiary care hospitals varied from 5.2 to 24.48 infections per catheter days in different settings.[4-6]

Most CAUTI can be prevented by implementing updated evidence-based practices (EBP).[7] However, these practices are not routinely implemented and there are variations in practices in different settings.[8] Therefore, there is a need to develop interventions concerning the specific barriers of different settings to improve the practices of healthcare workers for prevention of CAUTI.

Background

The most common cause of HAI is CAUTI, accounting for more than 40% of nosocomial infections, increasing length of patient stay and the cost of hospitalization; it also causes an extra 1 to 8days in the hospital. [9-10] A study in Thailand found that one episode of nosocomial urinary tract infection was associated with 10.7 extra hospitalization days and consequently increased the cost of hospital care.[11] The estimated treatment cost of urinary tract infections (UTI)in the United States was approximately between $758 -1,000 $US (22,740-30,000 baht) per infection.[12] In Thailand, a study found that the mean cost of antimicrobial treatment for one episode of CAUTI was $273 US (8,180 baht).[13] Moreover, CAUTI has increased the risk for cystitis, pyelonephritis, bacteremia, septic shock, and mortality[12] and is the second most common cause of nosocomial bloodstream infection, which has an attributable mortality of approximately 15% to 30% .[15,16]

The decision to insert a urethral catheter is the clinical judgment of physicians whereas catheter insertion and maintenance are important roles of nursing personnel. It is the role of the health care worker (HCW) team to prevent CAUTI. Effective evidence-based practice (EBP) for prevention of CAUTI can improve the practices of healthcare workers and result in reduced infections[15,17] Studies suggest that following the Center for Disease Control and Prevention EBP (CDC, 2010) results in the elimination of 20-70% of CAUTI.[18] However, despite efforts to implement EBP, there are still many instances where infection control practices are not followed regularly.[7,19] For example, urethral catheter care is a nursing procedure, the importance of which is sometimes overlooked.[20]A study in Japan found that one reason that nurses ignored recommended care for catheterized patients was because of reliance on antimicrobial urinary catheters and a resulting laxity in care.[19] Two studies in Thailand reported that the reasons for low compliance with guidelines were that they were developed by experts from other places and inappropriate to their workplaces, leading to low awareness and low compliance.[4, 21]

CAUTI problems are complex and need multidisciplinary teams to work together to improve patient care. Studies have shown that active participation in problem solving is one of the most effective methods for gaining commitment and acceptance. However, there is a lack of knowledge regarding the best strategies to improve the practices of HCWs regarding infection control guidelines. The practices of HCWs in three medical intensive care units in the present study were widely different although the hospital had an infection control policy for many years. Hence, the hospital needed to develop an appropriate infection control model for CAUTI prevention which involved the multidisciplinary team in their particular settings with concern for their specific barriers.

Theoretical Framework

Critical Social Theory (CST) informed the design and findings of this study, and participatory action research (PAR) was the chosen approach.

PAR methodologies were used to empower the Core Working Group (CWG) to develop a model for prevention and control of CAUTI. CST emphasizes empowerment or raising the awareness of the oppressed in different social situations. Empowerment encourages people to undertake activities to improve their situation and was thus a significant strategy used in this study to enhance participants' abilities to voice their needs, raise their awareness, and learn from a self-reflective process. CST also acknowledges the importance of knowledge, experience and expertise of each individual. Participatory action research is an approach demanding that participants perceive the need to change, and are willing to play an active part in research. PAR emerged from CST principles[22] which focus not only on empowerment but also participation, collaboration, knowledge and social change.[23] PAR seeks to empower individuals to create change in their situation, and as a method has four research stages in reoccurring cycles: reflection, planning, action, and observation[24, 25] In this study it was considered that involving all participants in PAR could create a sense of belonging among HCWs to foster better teamwork; improve their reflection on their clinical practice; and ultimately develop a model for CAUTI prevention to improve the patient outcomes by reducing infection rates. In PAR, participants are seen as equal. The researcher is a facilitator who allows participants to identify their practice problems and then plan action to change their situation.

Study Aim

The aim of the study was to develop a preliminary model for prevention and control of CAUTI in a university hospital in Thailand by involving the HCW. The first phase focused on PAR philosophy and methods, and on model development. This paper will present the findings of this phase.[26] The second phase involved model testing which will be described in a second article.

Method

Design: Participatory action research using a mixed method approach.

Ethical Considerations: Approval was obtained from the Research Ethics Review Committee Faculty of Nursing, Chiang Mai University and the research ethics committee of the hospital used as the study site. All participants received written and verbal explanations about the research purposes and process; the voluntary nature of participation; anonymity and confidentiality issues; and the right to withdraw from the study at any time, without repercussions. Those agreeing to participate were asked to sign a consent form.

Setting and Participants: The study took place at three medical intensive care units (MICUs) of a university hospital in Thailand. The settings of this study were selected by the HCWs' willingness to participate in the study, and the high incidence rate of CAUTI from nosocomial surveillance data of the hospital. The nurse supervisor introduced the researcher to the study settings.

The participants of this study were divided into 2 groups. The first group, the Core Working Group (CWG), was composed of 14 HCWs (three head nurses, three infection control ward nurses (ICWN), six registered nurses, one infection control nurse, and one hospital infection control physician). The inclusion criteria were that members volunteered to participate in the study, had at least three years experiences working in MICUs, and were committed to participate for the entire research process.

The other group was the Clinical Group, comprising 12 nurses, nine practical nurses, eight nurse aides, and two physicians who worked in the study settings. They volunteered to participate and undertook in-depth interviews.

Data Collection: Methods of data collection included focus group discussions with the nursing participants, in-depth interviews with the physicians, data from notes taken during workshops and group

meetings of the CWG. Guidelines for the focus group discussion and in-depth interviews were developed by the CWG and the researcher to solicit more in-depth information from the Clinical Group. There were five broad questions, for example: "What are your feelings or opinions about CAUTI?" and "What are the causes of CAUTI?" During the model development, CAUTI prevention knowledge was also developed for nurses, practical nurses and nurse aides, including definition of CAUTI, pathway of infection, the pathogens associated with CAUTI, updated EBP guidelines for CAUTI prevention, and hand hygiene. The content reliability was tested by 20 HCWs which resulted in Cronbach's alpha coefficients of 0.71, 0.70, and 0.70 for nurses, practical nurses and nurse aides, respectively.

PAR Process

The research process focusing on model development was divided into four steps.

Step 1: Establishing contact and mutual commitment

The researcher contacted the hospital administrators and the stakeholders including the head of the medical department, the nurse supervisors of the medical nursing division, and three head nurses of the settings to inform them of the objectives and the risks/benefits of the study, to ask for their research interest, and especially to obtain their commitment to participate in the study.

Step 2: Recruiting and enhancing the capacity of the Core Working Group

The 14 members of CWG were representatives of all HCWs in three MICUs. After raising their awareness by discussing the current situation of CAUTI problems in their units, they expressed their willingness to be co-researchers and the need to solve these problems. To enhance their ability to be involved in the study, the researcher facilitated a workshop for the CWG to share knowledge about the PAR process, methods of qualitative data collection, and updating EBP for CAUTI prevention. The role of the core CWG as a team to be leading their units was then established.

Step 3: Analyzing problems and identifying problem-solving strategies

This step aimed to empower the Clinical Group and the CWG, to increase their understanding of CAUTI problems and its prevention. The researcher and the CWG conducted five focus group discussions with 26 nursing personnel participants and conducted in-depth interviews with two physicians. A reflection process was employed using semi-structured, open-ended questions to elicit more in-depth information from the Clinical Group. These questions encouraged the participants to freely discuss CAUTI problems, barriers to infection control practices for prevention of CAUTI, the need for improvement and strategies to solve these collective problems. Then, the CWG and the researcher organized group meetings to analyze and reflect on the data collected from the Clinical Group. The CWG also shared their own understandings and ideas about CAUTI situations. After group discussions and brain storming, the findings from situation analysis were identified and summarized.

Step4. Developing the model for prevention and control of CAUTI

The researcher and the CWG facilitated meetings with representatives from all levels of HCWs in MICUs including nurse supervisors to present data from situational analysis and obtain their opinions and consensus for potential strategies. In this way, the CWG and the researcher provided several update EBP for CAUTI prevention to the stakeholders to use as guidance to develop the model. Finally, there was agreement to select the EBP guideline of the CDC (2009), a systematic review of 249 studies, to be used as guidance for developing the tentative model.[30]

Next the first researcher translated the content of the EBP guideline into Thai with the assistance of the CWG and the content was back-translated by

an expert in this field. The draft of the EBP was approved and revised according to the experts' suggestions, and distributed to the stakeholders, including the hospital infection control physician and nurse, another physician, and nurse supervisors. The EBP was then finalized after suggestions from the stakeholders. A public hearing for the stakeholders was convened to enable them to freely discuss and share their experiences, give suggestions about CAUTI problems and potential strategies to solve these. Finally the components of the tentative model were identified by considering constraints and limitations in their settings.

Following this, several group meetings were arranged to brainstorm with the CWG, and a tentative model was formulated based on key features gained from the stakeholders. The details of each component were adjusted after CWG suggestions. The final components of the Model were approved by the researcher's advisory team and revised according experts' suggestions.

Data analysis

Qualitative data from interviews and focus group discussions were analyzed using content analysis method described by Krippendorff (2004). The researcher first transcribed the qualitative data, which were reviewed, and coded into categories, and then emerging themes identified within each category.[27] Finally, these themes were verified through a reflection process by the Clinical Group and the CWG.

Rigor and trustworthiness

The principle of trustworthiness suggested by Guba and Lincoln (1989) were applied to assure the rigor of the study.[28] Multiple methods of data collection or triangulation were used to compare a variety of data to confirm the accuracy of the findings, including focus group discussions, in-depth interviews, group meetings, and reflection records of the CWG. In addition, the findings were discussed with an advisory team to verify accurate interpretation. A clear audit trail showed all findings were derived directly from the data and thus this helped to ensure comfirmability.[29]

Results

The results of this study are presented in two parts: identification of CAUTI problems and the critical components of the Model for the Prevention and Control of CAUTI.

Identified CAUTI problems and potential strategies to guide model development

The clinical group identified six main issues related to CAUTI:

1. *Inappropriate practices in CAUTI prevention and control.* All levels of HCWs indicated the cause of CAUTI was from inappropriate practices in urinary catheter insertion and caring for patients with indwelling catheters. These were identified as: incorrect sterile technique for catheter insertion; different or inappropriate techniques for urine emptying; urine bag position higher than the patients' bladder level while transferring or urine emptying; inappropriate technique for perineal care; and ignoring the need to secure the urinary catheter. Physicians and nurses stated that the causes of CAUTI mostly came from cross-infection from the hands of HCWs, for example:

> A non- sterile technique of urinary insertion, I think sometimes they don't mean to do that but when they slip some techniques, they might think that it is just one time, it may not cause an infection. (a nurse)

2. *Lack of up-to-date CAUTI prevention guidelines.* Most HCWs voiced their concerns about outdated guidelines, and practical nurses and nursing aides were very concerned that they did not have up-to-date guidelines. In contrast, some nurses reflected that they already had the updated guidelines, but rarely had a chance to read them.

> We should have a guideline which comes from the results of update research and I will follow it. (a practical nurse)

3. *Lack of knowledge about CAUTI prevention.* Every level of HCW stated that they lacked knowledge about CAUTI issues, especially the practical nurses and nurse aides. Additionally, they claimed there was no standard EBP for the three MICUs. However, some nurses stated that although they knew about the updated EBP, they rarely read these. In addition, nurses reflected that there were insufficient scholarly activities at their workplace, and practical nurses and nurse aides revealed that they lacked opportunities to attend in-service education, particularly for CAUTI prevention.

> We would like to attend education related to the practice of low level of HCWs because nurses already attended the training quite often, but practical nurses and nurse aides rarely have a chance to join in. (a practical nurse)

4. *Lack of awareness about CAUTI.* Some HCWs were unaware of the impact of CAUTI or overlooked their important role in preventing it. Similarly, physicians were not aware of how long each patient retained their urinary catheters and did not know that the CAUTI caused the highest rate of hospital-acquired infections in MICUs. One physician commented that CAUTI was not as big a problem as ventilator-associated pneumonia (VAP) and was less concerned since it did not cause mortality in patients.

> I think CAUTI rate should be lower than VAP rate. Although the CAUTI rate is high, it is not a cause of death in patient like VAP, except in multidrug resistant infections or fungal sepsis from prolonged infection. (a physician)

5. *No continuous monitoring system about HCW practices regarding CAUTI prevention.* Some HCWs explained that a monitoring system in place was not enough, just a random check of some HCWs once or twice a year. Most nursing personal indicated there was no appropriate monitoring system for evaluating the practice of each HCW regarding guidelines for CAUTI prevention. In addition, practical nurses and nurse aides proposed a clearer job description for them to care for patients with urinary catheters, and:

> Sometimes, we know in advance that a quality assurance person will observe us, so we try to do it correctly every step.(a nurse aide)

6. *Ineffective communication and collaboration among the multidisciplinary team.* The information gained from HCWs reflected communication problems: between physicians and nurses about the necessity of urinary catheter use; and ineffective communication for launching new infection control measures, especially the practices for CAUTI prevention, and for disseminating CAUTI data.

> Sometimes, it was not clear about how to do it practically, regarding a new infection control measure, everybody did it from their understanding.(a practical nurse).

Suggestions and strategies for solving CAUTI problems.

Most HCWs reflected on the same solutions about education sessions and developing EBP guidelines for CAUTI prevention. Practical nurses and nurse aides gave clear suggestions about what they needed, such as appropriate education at a level they could understand, up-to-date videos, demonstration and return demonstration experiences, and EBP guidelines.

Nurses preferred a different way of learning such as knowledge management, for example, organize a group of HCWs who are expert in CAUTI prevention to share their experiences and learn from them. Nurses also suggested that CAUTI should be a patient care team project for which medical instructors or physicians should take responsibility. Additionally, nurses advised running a big campaign about CAUTI

prevention as a way to raise awareness of the issues. Physicians also asked for reminders about catheter removal and early notification by nurses regarding signs of infections. Two nursing personnel stated:

> I would like to attend education training which should include demonstration session, for example: urine bag emptying and perineal care. (a nurse aide)

> CAUTI prevention activities should include physicians and the patient care team (PCT). In addition, PCT should develop a guideline for the practice of every level of HCW. (a nurse)

Components of the Model for the Prevention and Control of CAUTI

After discussion about the findings from the situational analysis, the stakeholders identified the tentative Model for Prevention and Control of CAUTI. CAUTI issues and the resulting Model are presented in **Figure 1**.Each of the six Model components represent strategies to overcome CAUTI, and these related activities were based on the scientific evidence and adjusted after suggestions of the CWG as well as the needs of HCWs in the settings. These components are presented in **Figure 2** and described below:

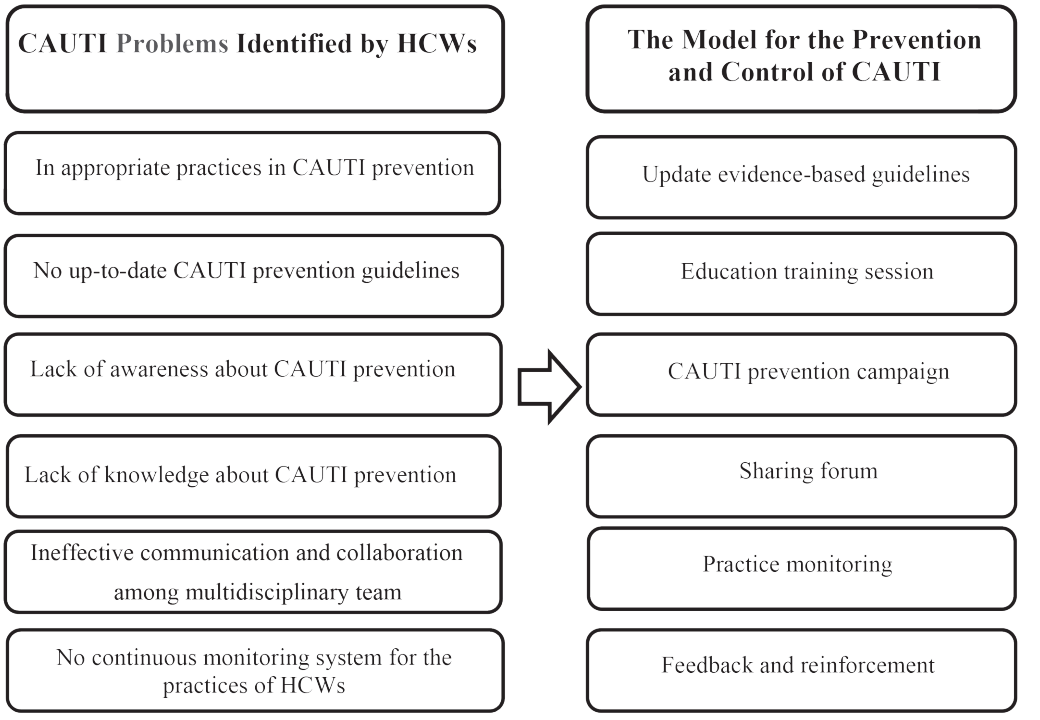

Figure 1 Identification of CAUTI problems and the Model for the Prevention and Control of CAUTI

Note. HCWs = healthcare workers,
CAUTI = catheter-associated urinary tract infection.

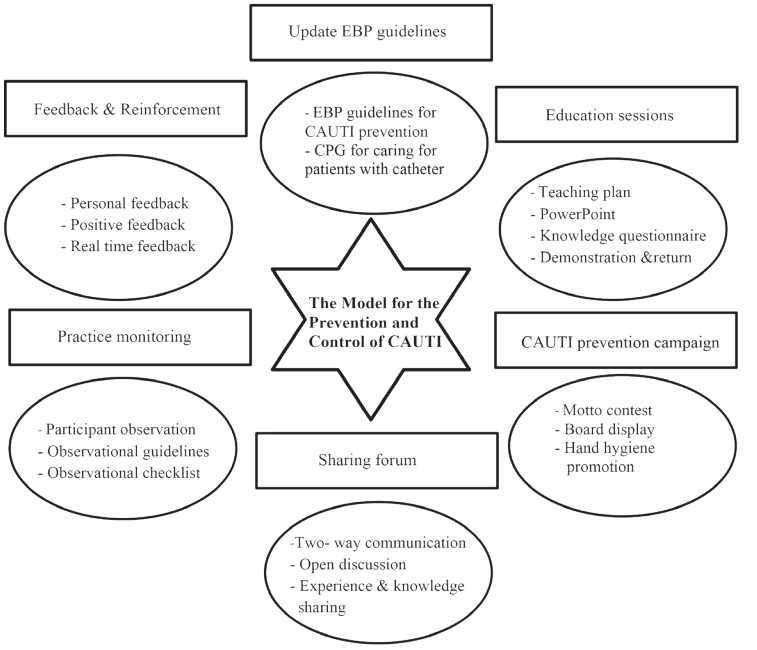

Figure 2 The Model for the Prevention and Control of CAUTI

Note. EBP =evidence-based practice,
CAUTI = catheter-associated urinary tract infection,
CPG = clinical practice guideline.

1) *Updated EBP guidelines for CAUTI prevention and control.* The evidenced-based guidelines were based on a systematic review for prevention of CAUTI (CDC, 2009) and consisted of two parts: EBP for CAUTI prevention and the clinical practice guidelines (CPG) for caring for patients with urinary catheters.

2) *Education training sessions.* Two teaching plans and PowerPoint presentations were developed, one for nurses, and one for practical nurses and nurse aides based on EBP for CAUTI prevention. Demonstration and return demonstration of CAUTI prevention and control procedures were held at three locations regarding urinary catheter insertion, perineal care, and urine bag emptying.

3) *CAUTI prevention campaign.* This was selected to raise the awareness of HCWs for CAUTI prevention by running the following activities: a motto contest for CAUTI prevention where prizes would be awarded to the top five mottos; a display board to promote CAUTI prevention. The contents of the board display would include the CAUTI infection rate, the top five winners of the motto contest for CAUTI prevention, and hand hygiene. Lastly a hand hygiene promotion using a black light to test the completeness of hand hygiene procedures of HCWs would be instigated.

4) *Sharing forum.* To enhance effective communication and collaboration among the multidisciplinary team, the researcher and the CWG would focus on two-way communication, facilitate open discussion and create a relaxed atmosphere to allow HCWs to freely discuss and share their experiences.

5) *Practice monitoring.* The CWG and the researcher will observe the practices of HCWs by using

the observational checklist and observational guideline that they developed. Before using the observational checklist, training needs to take place to observe the practices of the HCWs regarding CAUTI prevention, until the interrator reliability is equal to 1.

6). *Feedback and reinforcement.* The CWG will randomly observe the practices of HCWs after Model implementation, and will provide individual feedback and reinforcement.

Discussion

This study took place in MICUs of a university hospital and focused on the participation of all HCWs in the setting including a physician, nurses, practical nurses and nurse aides to develop the model for prevention and control of CAUTI. The actual implementation of the Model will be described elsewhere due to space restriction in this article.

PAR is a research methodology which seeks improvement through collaborative approaches to empower people to take systematic action to resolve specific problems.[31,32] We believe that participants who were involved in this study gained benefit from PAR as a methodological approach to empower them through raised awareness to understand more about their actual problems and identify solutions. As a result, with the active participation of the multidisciplinary team, a model was developed for prevention and control of CAUTI with concern for specific barriers in their setting.

Through the reflection process used during focus group discussion and group meetings, participants had an opportunity to raise their voices. They were encouraged to share their experience of providing care for patients with urinary catheters. The participants not only felt they lacked opportunity to share their experiences in caring for patients, they also expressed their needs for knowledge and skills to improve their capacity in caring for patients with urinary catheters. Additionally, some nurse aides reflected that having a chance to share their experiences with HCWs from other units, gave them more confidence to share their ideas and also improved communication among them.

In in-depth interviews, physicians admitted a lack of awareness about CAUTI issues and a misunderstanding that the impact of CAUTI was less than ventilator-associated pneumonia. Likewise recent studies examining the barriers to implementation of the CAUTI prevention initiatives found difficulty with physicians' engagement who often viewed CAUTI as less serious than other types of hospital acquired infections.[7, 33] Nurses raised their concern that collaboration among the multidisciplinary team was limited especially for evaluating with physicians the indications for urinary catheter use. After discussing CAUTI rates which had the highest rate of hospital-acquired infection in their setting, physicians showed concern about removal of unnecessary urinary catheters. They also asked for collaboration from nurses to remind them about catheter removal and early notification of signs of infections. Since infection prevention is everyone's responsibility, understanding different health worker roles is very important and substantially reduces infection risks.[34,35] Empowering nurses to remind physicians to remove unnecessary catheters can reduce infection rates and cost.[36]

The CWG in this study improved their capacity by raising their own awareness to explore CAUTI problems and understood more about the local context from the information gained from the participants. The CWG were the key stakeholders playing a major role and taking part in every process of model development. This participation can also create a sense of ownership which leads to the acceptance of the model such that it can make the outcome more meaningful to participants.[37,38] They reflected that they learned how to do research in a real clinical setting and how to work with a team. Additionally, they gained more knowledge and confidence about CAUTI issues and the research process. More importantly, the components and content of the Model were approved by the multidisciplinary team in their setting. Studies suggest that each healthcare setting has local customs and traditions, and

the CAUTI prevention initiatives should be adapted and tailored to the particular units.[39] Hence, this tentative Model was appropriate and accepted by the HCWs, and lead to positive practical consequences in the critical setting.

Limitations

This study was conducted in a specific medical intensive care unit to develop a tentative Model for the Prevention and Control of CAUTI. Since different settings have their specific problems and barriers, differences in settings may limit the generalizability of the findings and recommendations. Furthermore, physicians play an important role in CAUTI prevention effort by assessing whether the urinary catheter is still indicated but lack of engagement of a significant number of physicians in this PAR study may have affected the Model development.

Recommendations and Conclusions

As mentioned the results of the implementation of this Model will be described elsewhere, and future research that aims to test it needs to take place in different clinical settings with different contexts. We recommend that nurse researchers utilize participatory action research focused on multidisciplinary team involvement to solve other clinical problems.

This PAR was used to empower the CWG to develop a model for prevention and control of CAUTI at a university hospital in Thailand. The Model was formulated based on data which contained key features from all stakeholders to solve their collective CAUTI problems. Through the PAR process, the CWG developed their own capacity to create this model with concern for the specific problems identified by the HCWs in the setting. The components of this Model were updated evidence-based practice guidelines for CAUTI prevention, education training sessions, a CAUTI prevention campaign, a sharing forum, practice monitoring, and feedback and reinforcement.

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การพัฒนารูปแบบเพื่อป้องกันและควบคุมการติดเชื้อในระบบทางเดินปัสสาวะจากการคาสายสวนปัสสาวะในประเทศไทยโดยใช้การวิจัยเชิงปฏิบัติการแบบมีส่วนร่วม

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บทคัดย่อ: การติดเชื้อระบบทางเดินปัสสาวะจากการคาสายสวนปัสสาวะเป็นการติดเชื้อที่พบได้บ่อยในโรงพยาบาล การวิจัยเชิงปฏิบัติการแบบมีส่วนร่วมนี้มีวัตถุประสงค์เพื่อพัฒนารูปแบบเพื่อป้องกันและควบคุมการติดเชื้อจากการติดเชื้อในระบบทางเดินปัสสาวะจากการคาสายสวนปัสสาวะโดยใช้กระบวนการวิจัยเชิงปฏิบัติการแบบมีส่วนร่วม ด้วยการใช้กลยุทธ์ในการสร้างเสริมพลังอำนาจแก่คณะทำงานหลักจำนวน 14 คน ซึ่งเป็นบุคลากรที่ทำงานในหอผู้ป่วยวิกฤตทางอายุรกรรม โรงพยาบาลตติยภูมิแห่งหนึ่งโดยความร่วมมือของผู้เข้าร่วมการวิจัยที่เป็นบุคลากรทางการพยาบาลจำนวน 26 คนและแพทย์ จำนวน 2 คนรวบรวมข้อมูลโดยใช้หลากหลายวิธีได้แก่ การสนทนากลุ่ม การสัมภาษณ์เชิงลึก การจัดประชุมและการจัดประชุมเชิงปฏิบัติการ

ผลการศึกษาพบว่าปัญหาที่เกี่ยวกับการป้องกันการติดเชื้อในระบบทางเดินปัสสาวะจากการคาสายสวนปัสสาวะ ได้แก่มีความรู้ไม่เพียงพอขาดความตระหนัก ไม่มีระบบประเมินการปฏิบัติ ความร่วมมือของทีมสหสาขาวิชาชีพมีจำกัดและการสื่อสารไม่มีประสิทธิภาพรูปแบบการป้องกันการติดเชื้อในระบบทางเดินปัสสาวะจากการคาสายสวนปัสสาวะที่พัฒนาขึ้นจากการมีส่วนร่วมของบุคลากรในหน่วยงานประกอบด้วย 6 องค์ประกอบที่สำคัญคือ 1) การทบทวนแนวปฏิบัติเพื่อป้องกันการติดเชื้อในระบบทางเดินปัสสาวะจากการคาสายสวนปัสสาวะให้ทันสมัย 2) การอบรมให้ความรู้ 3) การรณรงค์เพื่อป้องกันการติดเชื้อในระบบทางเดินปัสสาวะจากการคาสายสวนปัสสาวะ 4) การจัดให้มีการแลกเปลี่ยนเรียนรู้ 5) การประเมินผลการปฏิบัติ 6) การให้ข้อมูลย้อนกลับและการเสริมแรง

ผลการศึกษาครั้งนี้มีข้อเสนอแนะว่ารูปแบบการควบคุมและป้องกันการติดเชื้อในระบบทางเดินปัสสาวะจากการคาสายสวนปัสสาวะที่พัฒนามาจากการมีส่วนร่วมของทีมสหสาขาวิชาชีพโดยการวิจัยเชิงปฏิบัติการแบบมีส่วนร่วมเป็นวิธีที่มีประสิทธิภาพและสามารถนำไปใช้ในการป้องกันและควบคุมการติดเชื้อในระบบทางเดินปัสสาวะในโรงพยาบาลได้อย่างเหมาะสม บทความต่อไปจะกล่าวถึงผลการนำรูปแบบที่พัฒนาขึ้นไปใช้ และในอนาคตควรมีการศึกษาถึงการนำรูปแบบนี้ไปทดลองใช้ในโรงพยาบาลอื่นและบุคลากรกลุ่มอื่น

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คำสำคัญ: การติดเชื้อในระบบทางเดินปัสสาวะที่เกี่ยวข้องกับการคาสายสวนปัสสาวะ การป้องกันและควบคุมการติดเชื้อ หลักฐานเชิงประจักษ์

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