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THE DEVELOPMENT OF NURSING CARE MODEL IN PATIENTS WITH TOTAL KNEE REPLACEMENT RECONSTRUCTIVE SURGERY

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Abstract

This research aims to develop a nursing care model for patients undergoing total knee replacement surgery (TKR) using the models Kemmis and McTaggart (1988) as development guidelines. The study has started from April to July 2020 in Operation Department, Loei hospital, Thailand. The purposive sampling method has been selected with participant nurses (n=50). The mixed method design has been used to obtain the new development nursing care model and guidelines for patient care, proper assignment system, and follow-up techniques. The result showed the nurse behavior changed before to after implementing a model in pre-operation, intra-operating, and post-operation stages statistically different at p less than .001 (mean = 4.9 ± 0.1, p<0.001, mean = 1.9

± 0.1 , $p < 0.001$, mean = 2.0 ± 0.0 , $p < 0.001$) respectively. The nurse's satisfaction level after cycle 2 was significantly higher than cycle 1 (mean = 4.2 ± 0.3 , $p < 0.001$). The development of the new nursing care model in TKR surgery could lead to changes in the system with gained positive feedback from OR nurses. The nursing leadership, group motivation, and a cooperative nursing team contributed to the successful operation of the new model. This research recommended following this model's protocols as a routine and further expanding to other departments such as outpatient, inpatient, and continuous care units.

Keywords

Nursing Care Model, Total Knee Replacement Surgery, Operation Room, Patient, Guidelines, Surgery, Nurse

1. Introduction

Osteoarthritis (OA) of the knee is a degeneration or destruction of the knee joint around the articular cartilage and nearby bones causing joint pain (Hu et al., 2021) joint stiffness, and bone sprouts (Mantyh, 2014). It is estimated that in the year 2018, there are up to 303 million patients worldwide, and by the year 2020 it will increase to 570 million people (Kloppenburger & Berenbaum, 2020). It is a major cause of disability in the group of world's populations increasing to 113.25% from 1990 to 2019 (Long et al., 2022). In Thailand, there are approximately 9.5 million patients with degenerative disease. Current treatments include supportive treatment with reduced movement, the use of crutches, pain relievers, and anti-inflammatory drugs (Mora et al., 2018). If the pain cannot be relieved, knee replacement surgery has been chosen as the treatment solution (Rönn et al., 2011).

The OA surgery may cause complications such as pain, infection, deep vein thrombosis, lose or dislodged prostheses, bloating, pressure sores, and psychological problems (Wehling et al., 2016). It can be seen that such surgery is beneficial to osteoarthritis patients but can cause complications. However, these conditions can be prevented by nursing procedures before surgery, during surgery, and after surgery (Jakobsson & Hallberg, 2002).

According to the medical records of Loei Hospital for the past 5 years illustrated that there were 70-80 patients undergoing knee arthroplasty per year. In 2019, the incidence of surgical postponement due to unavailability of equipment was 12 out of 71 times (16.9%), and redness and swollen wounds after surgery, in 2 patients (2.8%). Because of the lack of specific nursing

guidelines for this group of patients, lack of knowledge management in surgical nursing, and lack of follow-up supervision. The major barrier is the nursing practice level in terms of knowledge and experience. New nurses tend to have lower confidence in the preparation and delivery of equipment during surgery compared to senior nurses. It can be seen that there are many factors that affect nursing outcomes.

Therefore, the researcher applied the concept of Kemmis and McTaggart's action research to develop guidelines for nursing care of patients undergoing knee arthroplasty in the operation room department. This research process focuses on opening learning areas to bring each person's inner experience to create new knowledge in collaboration. OR staffs consist of senior nurses who have extensive experience in caring for this group of patients working with new nurses with modern knowledge including this research focus on solving systemic problems with direct participation face-to-face to solve problems. The knowledge in the real world with different places varied according to the level of experience, the number of staff, or other reasons. In Thailand, we have a variable size of the hospital which performed TKR surgery (Chotanaphuti et al., 2018). The knowledge from the case study model may need to apply to real situations (DeSanto-Madeya, 2007). The extant literature focused on pre-, intra-, and post-operation separately (Pulkkinen et al., 2016; Liu et al., 2019; mandour et al., 2022). This study may contribute to the three main processes of TKR in operation practice as the developing nursing guidelines intend to help nursing groups make decisions and practice nursing with the applied standard, and satisfaction with the use of nursing guidelines, including patients receiving protection and surveillance for complications from knee replacement surgery in wider implements, especially in small hospitals which need to start operating the TKR procedures. Therefore, this research aims to develop a nursing care model for patients undergoing total knee replacement surgery in Loei Hospital, Thailand.

2. Research Objective

To develop a guideline for nursing care of patients undergoing knee replacement surgery in osteoarthritis patients.

3. Literature Review

Operation nurses (OR) provide nursing services to take care of patients who come for surgery with various invasive procedures that must be performed in the operating room. OR nurses provide healthcare during Pre-operative, intra-, and post-operative periods which covers coordination with the nursing team, and anesthesiologist who provides anesthesia to make the successful surgery, coordinating with the team nurses in wards or postoperative care service units. OR nurses must also have knowledge of surgical procedures and methods, specialize in surgical equipment, and be specially trained to assist in performing surgery for patients to undergo surgery safely (Malley et al., 2015).

Model is the term for the structure of the relationship between factors that are important in a reason to each other to help understand facts in a particular matter with accuracy and reliability (Edmonds et al., 2019). The nursing care model was very challenging because of its specialization for each type of purpose and the number of experienced nurses in the model of each patient's care (Hall et al., 2004). The previous literature indicates that the lack of knowledge was the key barrier to the development of skills, especially among surgical nurses (Alexander et al., 2016). The knowledge of a nurse's operation is a vital role in the safe practice in the tertiary-level hospital (Li et al., 2022). It is necessary to expand the perioperative nursing specialty toward extended care because of the diversity of the nursing care model (Redondo-Sáenz et al., 2023) especially the lower-level hospital to expand the capability to surgical procedures such as TKR in order to standardize healthcare accessibility to patients. The findings of this research contribute to the area of standard in TKR surgery operations gathered from real practices.

4. Conceptual Framework Development

Kemmis and McTaggart's conceptual action research was used as a development framework (Kemmis & McTaggart, 1988). Because the group of nurses in the department consists of new nurses with modern knowledge and senior nurses with all-around experience in work. Everyone in the department is committed to developing nursing work. This research consisted of 2 cycles, cycle 1st focuses on the development of nursing guidelines, and cycle 2nd focuses on the application of nursing guidelines in routine work. Each cycle had 4 steps:

- 1) Planning by analyzing problem situations from patient medical records and interviews with operating room nurses. and plan to correct
- 2) Act to use the nursing guidelines, communicate and promulgate

3) The observation stage (Observe) by collecting the results from the use of the nursing guidelines.

4) Reflection: Bring results to share and learn. Improve and fix in the next cycle.

As in Figure 1.

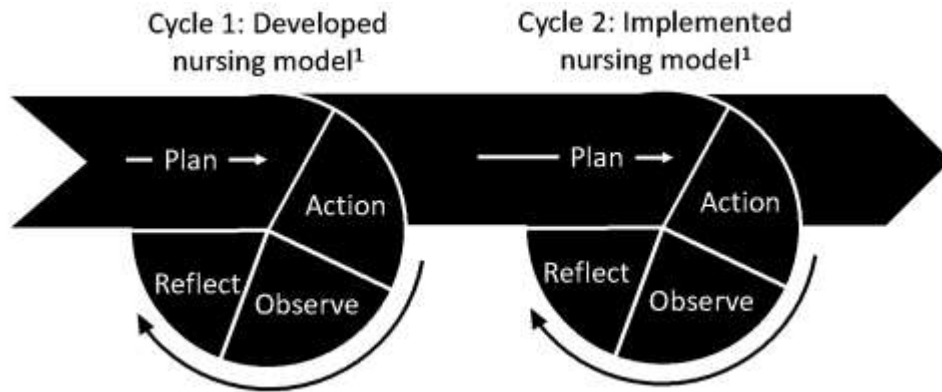


Figure 1: Conceptual Framework
(Source: Authors' Own Illustration)

5. Research Methodology

This mixed-method design has been conducted in April-July 2020. This mixed-method research has been used which offers powerful tools for investigating complex processes and systems, especially in the healthcare (Fetters et al., 2013). The population consisted of 50 OR nurses and 36 patients undergoing knee replacement. Patients' data has been collected from the retrospective medical records which are not directly collected to eliminate the interference of the treatment process when the patient is unable or under medical care after surgery.

The OR nurses' participants were selected by purposive sampling method. The inclusion criteria were registered nurses, with at least one case experience in the knee replacement surgery team and willing to participate in the research voluntarily. The 1st brainstorming and reflection meeting in April 2020 to return interview information. analyze the situation identify joint problems and design nursing guidelines. The 2nd meeting in May 2020 with the clinical leadership team in the field of orthopedic surgery. 5) Presented at the nursing group meeting to bring nursing guidelines to trial for 6 weeks.

The research tools included 1) The assessment form for the use of nursing guidelines contains 70 items, with category choice: practical and non-practice. It covered 25 items were

preoperative nursing, 39 items for nursing during surgery, and 6 items for postoperative nursing. 2) The satisfaction form towards the nursing guidelines consisted of 8 items, divided into 2 parts: Personal information of operating room nurses and satisfaction. Content validity has been approved by 5 experts in total knee replacement care both surgeons and nurses. A five-pointed Likert scale has been used which 5 means strongly agree and 1 strongly disagree. The pilot study has been done (n=15) with Cronbach's alpha coefficient was 0.89 which is accepted when greater than 0.70. 3) Guidelines for in-depth interviews and brainstorming instructions have been developed by relevant academic reviews and the consensus of the research team. Triangulation methods were used through depth-interviews, brainstorming, and reflection sessions to assess the nursing guidelines in terms of information analysis. Data were collected from both sides between nurses and patients with two intervals of time between two periods months apart.

5.1. Data Collection

In-depth interviews of 15 people, including five nurses, five nurses less than one year old, and five nurses more than one-year-old, to recognize and confirm the problems and nursing situations in the unit. using semi-structured in-depth interview (Joungtrakul et al., 2013). Second, brainstorming and reflection group (n=50) three times to return information and confirm the correctness of the information as well as expanding the scope of awareness, making plans for remediation and evaluating/improving. Third, evaluate the usage of the nursing guidelines and assess their satisfaction with the nursing guidelines two times, with nurses self-assessing at the end of cycle one and cycle two.

5.2. Data Analysis

- 1) Qualitative use content analysis has been used to finish both cycles. Classifying key points, categorizing, validating, linking, and summarizing issues bring the text to write in written language in the form of the original sentence or a new sentence with the same meaning by content analysis method (Creswell, 2013).
- 2) Quantitative statistics by frequency, percentage, mean, and standard deviation. The mean scores for using the nursing guidelines and their satisfaction level were analyzed by paired sample t-test with STATA.

5.3. Research Ethics

To protect the rights of research participants, this study had been approved by Loei Hospital Research Ethics Committee (LHREC) with reference no. EC 025/2563, dated 16 April 2020. Before obtaining consent to participate in the research by signing. The researcher had clearly explained the research objectives. Participants could be able to withdraw or quit the project at any time without affecting their benefits. Data were kept confidential and destroyed or deleted at the end of the study within a month.

6. Results

The first cycle has been done and identified four root causes. The first was the complexity of roles and responsibilities. The second was knowledge management. The third was nurse rotation. The fourth was individual issues. The samples mentioned that knowledge management was not well-organized and could not learn from the model. The roles and rotation structured the staff to rotate to other departments, not just the orthopedics department. So, they could not manage to be expertized.

The second cycle has discussed how to prevent the causes mentioned in the previous cycle. The sample has been summarized and identified three challenges and four protocols as guideline development plan models. We found the complexity of the roles, unclear education, and unclear roles as challenges to the model's success. The four protocols have been introduced as job rotation practices, case conferences, follow-up plans, and clinical guidelines. As in table 1.

Table 1: *The Qualitative Finding from Two Cycles*

STEPS	Cycle 1	Cycle 2
Plan	Pre-operative model Peri-operative model Post-operative model	3 challenges identified: complexity of the roles, unclear education, unclear roles 4 protocols developed: job transfer, conference, follow-up plan, clinical guidelines
Action	Identified; Complexity of roles, Nurse rotation, Knowledge management,	Implemented the protocols for 6 weeks

	Individual issues	
Reflect	Still had some misunderstanding Peri- and post-operative protocols were not completed	Satisfaction score: 4.22± 0.37 Improved the quality of care Reduced working duration
Observe	Observed and evaluated implementation and satisfaction (May 4, 2020 – Jun 12, 2020)	Observed and evaluated the implementation and satisfaction (Jun 25, 2020 – Jul 24, 2020)

(Source: Authors' Own Illustration)

The quantitative study has been analyzed as pre-operation step, before implementing stage, the highest is surgical device preparation (72%) of nurses has done this and the lowest is pre-operation visitation (40%). After the incision is the highest between intra-operation (86%) and before incision (64%). Immediate post-operation (90%) is the most action the OR nurses had done before implementing the model.

After Cycle two, the study offers four implementation plans

- 1) The nurse standard of TKR,
- 2) a workshop on the topic “*Standard nursing care for TKR patients for OR nurses*” – Knee anatomy course review, symptoms, treatment, and nursing course,
- 3) Development of follow-up plan by the head of the nurse in pre-, intra, and post-operation every week and add the follow-up plan into patient’s medical records, and
- 4) The handbook of TKR nursing in Operation room practice as in picture 2.



Figure 2: The Cover of Handbook for TKR

(Source: Authors' Own Illustration)

The study has improved the new nursing care model for TKR patients in this protocol by using two cycles of Kemmis and McTaggart's as in figure 3.



Figure 3: The Process of Developing TKR Nursing Care Model

(Source: Authors' Own Illustration)

The TKR steps have been introduced and used for 6 weeks before the evaluation the survey from the OR nurses. The three steps of TKR surgery as:

Step 1: Pre-Operation

1. Visit one day in advance before surgery, and health evaluation, and discuss the patient's concerns.
2. Preparing the Operation Room and equipment such as the operating table and its accessories, air flow, X-ray film, and MRI.
3. Check the other special instruments required for TKR surgery.
4. Check for the TKR implant kit and prosthesis equipment.
5. Patient sig in case follow WHO standard and check the drug needed.

Step 2: Intra- Operation

- a. Patient set up before Surgery.
 1. Apply the tourniquet to the site of surgery.
 2. Monitor the patient with Anesthetic steps.
 3. Follow the one-page regulation.
 4. Clean the leg for five minutes in the hold 45-degree angle position.
 5. The nurse team clean their hands for five minutes and dree in the sterile gown.
 6. Sterile the surgical site.
 7. Drave the sterile site.
 8. Set up an instrument such as ESU, suction unit, and operation light handles.
- b. Intra- Surgery
 1. Counting step Time out by WHO standard.
 2. Open the surgical site with the surgeon.
 3. Surgical site preparation
 4. Implantable equipment preparation.
 5. Insert implant to follow WHO standards.

Step 3: Post-Operation

1. Instant post-operation practice.
2. 24 hours post-operation practice.

The study has developed the assignment regulation for TKR surgery as followed:

1. Competency of TKR nursing care has been categorized into five levels. Level 1, Nurses will be able to know the basics of TKR surgery required for instrument check and preparation monitored by the head of the team. Level 2, Nurses will be able to know the basics of TKR surgery required for instrument check, preparation, and support as an outside-sterile field, scrub nurses are monitored by the head of the team. Level 3, Nurses will be able to know the basics of TKR surgery required for instrument check, preparation, support as an outside-sterile field, scrub nurses, and help to support surgeons without being monitored by the head of the team. Level 4, Nurses will be able to know the basics of TKR surgery required for instrument check, preparation, support as an outside-sterile field scrub nurse, and help to support the surgeon without being monitored by the head of the team. This level needs the ability for problem management and emergency matters. Level 5 Nurses will be able to know the basics of TKR surgery required for instrument check, preparation, and support as sterile field scrub nurses and help to support the surgeon without being monitored by the head of the team. This level needs the ability for problem management and emergency matters. They need to work as supervisors for research and development purposes.
2. The suggested TKR surgery team should compose of four nurses one Assistant surgeon nurse 1; AN1, one Assistant surgeon nurse 2; AN2, Scrub nurse; SN, and Circulating nurse, CN.
 - a. AN1: experience of more than five years was accepted, competency level 5.
 - b. AN2: experience of less than one year was accepted, competency level 3 or 4.
 - c. SN: experience of less than one year was accepted, competency level 1 or 2.
 - d. CN: experience of less than one year was accepted, competency level 1 or 2.
3. Workshop for TKR procedure turning every six weeks.
4. Follow-up plan conducted with the head team every week.

The evaluation of the nursing care model has been analyzed by paired sample test to show that before and after implementing the nursing care model at the pre-operation stage the mean average was statistically increased in nursing actions (mean = 4.9 ± 0.1 , $p < 0.001$). For the Intra-operation stage, the mean average after implementing action was statically higher than before implementing (mean = 1.9 ± 0.1 , $p < 0.001$). The post-operation stage significantly differed between the two groups (mean = 2.0 ± 0.0 , $p < 0.001$) as in table 2.

Table 2: Comparison Between Before and After Complementation (N=50)

Nursing Model	Target (%)	Before implementing	After implementing		p-value
			Cycle 1	Cycle 2	
1. Pre-operation		2.7 ± 2.1	4.1 ± 1.5	4.9 ± 0.1	<0.001
1.1 Pre-operation visitation	100	20 (40%)	48 (96%)	50 (100%)	
1.2 Theater preparation	100	22 (44%)	35 (70%)	50 (100%)	
1.3 Equipment preparation	100	22 (44%)	35 (70%)	50 (100%)	
1.4 Surgical device preparation	100	36 (72%)	44 (88%)	49 (98%)	
1.5 Patient preparation	100	33 (66%)	43 (36%)	50 (100%)	
2. Intra-operation		1.5 ± 0.7	1.7 ± 0.5	1.9 ± 0.1	<0.001
2.1 Before incision	100	32 (64%)	39 (78%)	50 (100%)	
2.2cAfter incision	100	43 (86%)	47 (94%)	49 (98%)	
3. post-operation		1.4 ± 0.6	1.9 ± 0.2	2.0 ± 0.0	<0.001
3.1 Immediate post-op	100	45 (90%)	49 (98%)	50 (100%)	
3.2 24-hour post-op	100	26 (52%)	49 (98%)	50 (100%)	
Total		5.6 ± 3.4	7.8 ± 2.1	8.9 ± 0.3	<0.001

4. Satisfaction			2.91 (±0.4)	4.20 (±0.3)	<0.001
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(Source: Authors' Own Illustration)

The result showed the satisfaction level of OR nurses by mean average has been statistically increasing from 1st cycle compared to 2nd cycle (mean = 4.2 ± 0.3, p<0.001) respectively.

7. Discussion

The development of nursing guidelines for patients who have undergone artificial knee replacement surgery causes the conversion of nurses in the patient care unit according to the jointly established nursing guidelines. A task assignment system and a follow-up supervision system were formed as well as translating lessons learned to summarize knowledge as a manual for operating room nurses in caring for artificial knee replacement patients. The research results are contributed to 1) Achievement of nursing goals, making decisions, and practice of nursing activities according to the standards set from 2 cycles according to Kemmis and McTaggart's concept. The result suggested the increasing nursing approach helps to achieve the standards, increase the quality of patient care and achieve nursing goals in a faster time (Thomas et al., 1999). In addition, it also increases the accuracy and coverage of the nursing care (Nakpalad et al., 2019), the development of a practice guideline for the rehabilitation nursing of elderly patients with artificial knee joint surgery increased nursing efficiency by the group of nurses in the agency participated in every step of the operation. Therefore, nursing activities were transferred from the knowledge and on-site experience, and 2) Satisfaction with nursing guidelines. The study explored that the nursing group's satisfaction increased from 2.91 ± 0.4 to 4.20 ± 0.3, which was at a high level. This finding supported that nursing care plans could help nurses to be satisfied (Lin et al., 2011). The use of the guideline made all nurses satisfied at a high level (100%) because the nursing guideline could be used in real nursing practice and benefit patients as an outcome.

This study also introduces satisfaction as a key indicator to prove the success of the nursing care model which promotes a positive environment in the workplace enhancing the caring attitude (Reyes, 2019). The experienced nurses have been also reflexed the nursing competency in TKR procedure as the team leaders and supervisors who are able to pass the knowledge to other

members of the OR nurses team member similar to the study in the field of the education system (Reyes III et al., 2022). Team building strategies should be used to enhance collaboration and performance development among them (Havaei et al., 2019).

8. Conclusions, Recommendations, And Limitations

The results of the research established a standard of nursing care for patients undergoing total knee replacement surgery. The result also introduced the operating room nurses' guidelines for nursing decisions and providing care to patients under the same standards. This research finding should be applied to regular work with the adjustment of the task assignment system and follow-up supervision system so that patients receive nursing care with efficiency and safety. The limitation of this study is done only TKR nursing care model. The use was limited by the specialty of the procedure and only in the operation room. Future research should be the guidelines for nursing care should be developed for the whole system including the outpatient department, and inpatient ward. The efficiency of knowledge management in operating room nursing should be focused on other models such as a mentor or adult learning.

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