

# The Relationships Among Age, Body Mass Index, Recovery Symptoms and Functional Status in Patients after Total Knee Replacement

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## ABSTRACT

**Background:** The recovery period after total knee replacement (TKR) is perceived as one of crisis and associated with recovery symptoms, and adverse physical functioning.

**Objective:** To study the relationships among age, BMI, recovery symptoms and functional status in Thai TKR patients. **Methods:** A cross-sectional correlational design with patients after TKR who were first followed-up at the university hospital were conducted. The data was collected by questionnaires on demographic and clinical characteristics. The recovery symptoms after TKR were measured using the recovery symptoms and their functional status was measured using the Modified Thai WOMAC score. Descriptive statistics and Pearson product moment correlation coefficient were utilized for data analysis **Results:** This study included 88 eligible patients, (74 women, 14 men) with an average age of 67.63 years (S.D.=7.9), with an average BMI 27.46 kg/m<sup>2</sup> (S.D.=3.91). The most common recovery symptoms were pain (mean=6.41, S.D.=0.95), limping (mean=5.02, S.D.=2.62), and numbness (mean=4.57, S.D.=2.64). The functional status found that most had heavy domestic duties (mean=9.82, S.D.=0.51). Recovery symptoms had a positive relationship with functional status (r=0.395, p<0.01). However, age and BMI were not statistically significant with functional status (r=0.037, 0.033, p>0.05 respectively). **Conclusion:** This finding provides a beginning explanation about the phenomena of age, BMI, recovery symptoms and functional status in a specific culture, Thai TKR patients. Interventions to improve functional outcomes in Thailand should be tailored to recovery symptoms management.

Keywords: Total knee replacement, age, body mass index, recovery symptoms, functional status

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## **INTRODUCTION**

otal knee replacement (TKR) is a treatment of knee osteoarthritis to relieve pain and improve mobility when conservative treatments have failed.<sup>1</sup> In Thailand, there is no report on the number of patients undergoing TKR. However, according to Thailand Arthritis Foundation, in 2006, the number of patients with knee osteoarthritis was higher than 6,000,000 patients and the number has tended to increase due to the increasing elderly population.

Correspondence to: Ketsarin Utriyaprasit E-mail: ketsarin.utr@mahidol.ac.th Received 25 July 2013 Revised 31 October 2013 Accepted 12 December 2013 In general, TKR is aimed to improve quality of life. However, it takes patients about one year to return to normal functional status.<sup>2,3</sup> During the recovery period, patients have to encounter problems in functional status such as walking, walking up or down stairs, sitting, having movements, fulfilling domestic duties, and performing activities of daily living and activities requiring energy exertion.<sup>2,4</sup>

In addition, patients are faced with recovery symptoms during the early recovery phase. These symptoms include pain,<sup>2,5</sup> swelling,<sup>5,6</sup> numbness,<sup>7</sup> nausea, vomiting, stomachache, lack of appetite, and constipation.<sup>8</sup> Recovery symptoms and their relationship with functional status after TKR have been evaluated in a number of studies, most of which focus on relationships between pain and functional status.<sup>2,3</sup>

Most of the patients undergoing TKR are elderly.<sup>9</sup> They are likely to have co-morbidities that give them more risks to postoperative complications than patients in other age groups.<sup>10</sup> In contrast, some studies have found that age has no effect on functional status in patients after TKR;<sup>11</sup> therefore, more studies are needed.

There has been much interest concerning how patients undergoing TKR have higher BMI than normal.<sup>12</sup> BMI is another factor which affects functional status, as higher BMI has more likelihood for postoperative complications and poorer outcomes of TKR.<sup>13</sup> However, in other studies comparing BMI, it was found that BMI has no effect on functional status after TKR.<sup>14</sup>

In Thailand, there are no studies investigating the relationships among age, BMI, recovery symptoms, and functional status in TKR patients. The present study aimed to explore age, BMI, recovery symptoms, and functional status, and examine their relationships in patients after TKR at the first follow-up (2 weeks) to better understand the early recovery phase in TKR patients.

## **MATERIALS AND METHODS**

#### Participants and sample size

Participants were patients after TKR, recruited by convenience sampling from a university hospital in the central region of Thailand between September and December 2012. Patients who met the following inclusion criteria were approached: (a) suffering from knee osteoarthritis, (b) undergoing TKR for the first time, (c) having first follow-up following discharge, (d) being mentally competent, and (e) being literate in Thai. The exclusion criteria were (a) having a co-morbidity affecting functioning and mobility and (b) having history of psychoneurological abnormality.

The sample size was calculated using the Table of Power Analysis of Polit and Beck<sup>15</sup>, with the level of confidence ( $\alpha$ ) of 0.05. The power of test was 0.80, with the effect size of 0.30. A sample size of 88 was necessary.

#### Instrument for assessments

Recovery symptoms were measured using the Recovery Symptoms modified by the researcher from the Activities of Daily Living Scale of the Knee Outcome Survey<sup>16</sup> and the Symptom Inventory.<sup>17</sup> It was a 27-item checklist with one open-ended questions. Using a scale from 1 to 7, the subjects were asked to describe the frequency with which given symptoms occurred during the previous week. A total score was calculated by summing the item scores. Higher scores indicated more severe symptoms. To determine the content validity of the instrument in this study, the instrument was submitted to three specialists at a university hospital who were experts in caring for patients after TKR. The reliability in this study was assessed by using Cronbach's alpha and was found to be 0.70.

Functional status was measured by using the functional dimension of The Modified Thai WOMAC (Western Ontario and McMaster University Osteoarthritis Index).<sup>18</sup> It is composed of 15 items arranged in a numeric rating scale with the scores ranging from 0 to 10, to elicit data regarding functional status of knee joints in different

postures. Higher scores reflected lower functional status. Reliability in this study was assessed by using Cronbach's alpha and was found to be 0.87.

#### **Data collection**

Human subjects' approval was obtained from the Siriraj Institutional Review Board (Si 348/2012). Prior to the start of data collection, the researcher contacted the head nurse and other staff nurses of the orthopedics ward and orthopedics clinic to ask for cooperation in the study. Patients who met the inclusion criteria were approached consecutively by the researcher on the day before their operation and were invited to participate in the study. Their informed consent was obtained. On the day of the first follow-up after discharge from the hospital, while TKR patients were waiting for the physician or when the physician and nurse completed the routine procedure, data collection was conducted by using the demographic and clinical profile questionnaire, recovery symptoms questionnaire, and functional dimension of The Modified Thai WOMAC, respectively.

#### Data analysis

Demographic data and clinical profile were analyzed using descriptive statistics, and Pearson's product moment coefficient was employed to determine the relationships among age, BMI, and recovery symptoms, and functional status in patients after TKR at first follow-up.

### RESULTS

As for demographic data of TKR patients (n=88), most of them were female, were married, had primary education, and were unemployed with income ranging

TABLE 1. Demographic characteristics of TKR patients (n=88).

Characteristic	Frequency	Percentage
Gender		
Female	74	84.1
Male	14	15.9
Age		
51-60 (years)	21	23.9
61-70 (years)	32	36.4
71-80 (years)	35	39.8
(Mean = 67.63, S.D. = 7.59)		
Body mass index (BMI)		
18.50-24.99 kg/m <sup>2</sup> (normal)	22	25
$25.00-29.99 \text{ kg/m}^2$ (over weight	nt) 44	50
$\geq 30 \text{ kg/m}^2 \text{ (obesity)}$	22	25
(Mean = 27.46, S.D = 3.91)		
Marital Status		
Married	58	65.9
Widowed	20	22.7
Education level		
Primary school level	53	60.2
Secondary level	13	14
Bachelor	14	15.9
Occupation		
Unemployed	53	60.2
Private business	14	15.9

**TABLE 2.** Age, body mass index, recovery symptoms, and functional status of TKR patients (n=88).

Variables	Actual	Mean	S.D.	Median	Mode
	Range				
Age	51-79	67.63	7.59	69.00	69
Body mass index	19.09-37.19	27.46	3.91	26.36	24.80
Recovery	32-102	65.00	14.64	65.00	65.00
symptoms					
Functional status	84-136	110.74	11.36	112.00	106.00

from 5,001 to 10,000 baht/month, and had government reimbursement as shown in Table 1.

More than half of the subjects (51.10%) had osteoarthritis in their left knee. None had postoperative complications. Most of the subjects had more than one chronic condition, with hypertension (53.40%) being most commonly found, followed by dyslipidemia (36.40%) and diabetes mellitus (28.4%).

After TKR surgery, the mean length of hospitalization was 4.95 days (S.D. = 0.84). The mean interval between hospital discharge and the first follow-up examination was 11.19 days (S.D. = 3.26), and the mean interval between post surgery and first follow-up examination was 16.17 days (S.D. = 3.51).

At the first follow-up after TKR, according to Table 2, most of the subjects were elderly persons (mean = 67.63 years, S.D. = 7.59). Their BMI was higher than the normal level, or overweight. The mean scores of recovery symptoms and functional status were 65 points (S.D. = 14.64) and 110.74 points (S.D. = 11.36), respectively.

When ranking severity of recovery symptoms, the five leading symptoms were pain, limping, knee numbness, anxiety, and knee swelling.

When considering the mean score of each aspect of functional status, the top five activities that were found to be most problematic for patients were doing heavy domestic duties, going shopping, walking upstairs, walking downstairs, and walking on a flat surface, respectively. On the other hand, the activities that were least problematic were taking off pants, rising from bed, and putting on pants, respectively.

At first follow-up, as shown in Table 3, there was no relationship between age and functional status or BMI and functional status. However, there was a statistically significant positive relationship between recovery symptoms and functional status at a moderate level.

**TABLE 3.** The relationships among age, BMI, recovery symptoms and functional status of TKR patients by Pearson's Product Moment Correlation Coefficient (n=88).

Variables	1	2	3	4
Age	1			
Body mass index	.117	1		
Recovery symptoms	.041	.106	1	
Functional status	.037	.033	.395**	1

\*\*p<.01

## DISCUSSION

The TKR patients in this study had a high level of BMI, with the mean score in the overweight level. Such a finding yielded support to the findings of previous studies that most patients undergoing TKR had BMI at an overweight or obese level.<sup>5,12</sup> This could be explained that an increase in body weight causes the knee joints to work harder, thus an increase in dynamic force through the joints and wear and tear of the joint, with one kilogram increase in body weight resulting in an increase in the dynamic force on the knee joint by four kilograms<sup>-19</sup> It is worth noting that in this study, even though the mean BMI of the patients was at an overweight level, the mode BMI score of most patients was at a normal level. Thus, it may be assumed that Thai culture and way of life may have played roles in triggering osteoarthritis in Thai patients.

The most frequently occurring symptoms of TKR surgery patients were pain, limping, knee numbness, anxiety, and knee swelling. Although there is no study that has explored all symptoms in patients after TKR surgery, there is a similar study that investigated health care needs of patients during early recovery after TKR. It has been reported that limitations on knee mobility, pain, and ecchymosis are the top three distress symptoms of Taiwanese TKR patients after hospital discharge.<sup>5</sup> Pain management was the first health care need of them.<sup>4</sup>

As regards findings of recovery symptoms, limping and numbness were common symptoms. In fact, they are well recognized complications after TKR surgery. Limping results from pain in the incision area when it has to bear normal weight and from the weakening of the quadriceps muscles in the operated knee.<sup>20</sup> Thus, the patients have to adjust the gait by putting more weight on the other knee that is not operated on to reduce the weight which the operated knee has to bear. Numbness is a direct effect of the surgery that results in an injury of the fibers in the surrounding area as well as an injury of the neurons in the knee, mostly the infrapatellar branch of the saphenous nerve.<sup>7</sup> Numbness should finally subside within three to six months after TKR surgery.

In this study, anxiety is the emotional symptom that occurred sometimes with TKR patients. This is consistent with previous findings in TKR patients. Anxiety begins right after the surgery, ranging from mild to moderately severe.<sup>21</sup> It was found that at the first follow-up, 71.6% of the patients continued to suffer from anxiety. This was different from findings of a previous study in a Midwestern hospital in the United States in which only 4.3% experienced anxiety symptoms.<sup>21</sup> A plausible reason may be the difference in research study designs as the subjects of the previous study had prior knee surgery.

In the current study, some patients suffered from knee swelling sometimes after they had returned home after hospital discharge. This finding was congruent with previous studies.<sup>3,5</sup> Knee swelling is a distress symptom that happens from after operation to one month after TKR. Knee swelling after TKR is an inflammatory response to cell injury. In general, swelling reduces within seven days after surgery.<sup>22</sup> In this study, severity of swelling may be caused by increasing activities at home. Age was not related to functional status. This finding was inconsistent with the findings of previous studies which have indicated a negative relationship between age and functional status,<sup>10</sup> with older patients having poorer functional status. However, there were other studies which have reported that functional status did not vary with age.<sup>11</sup> This finding in our study may have been because this study investigated the mean age of patients. Therefore, further studies should collect additional data by specifying age groups. Moreover, the association between age and functional status after TKR requires further studies to clearly delineate this association.

In this study, BMI was not associated with functional status, unlike previous studies which reported that patients with normal or overweight BMI had better physical functional status at hospital discharge than those with obese BMI. It has also been documented that BMI is related to return to normal functional status.<sup>13</sup> However, there are a number of studies which have reported that BMI does not have an effect on functional status after TKR.<sup>14</sup> In this study, it was found that BMI was not related to functional status after surgery. Thus, further studies should explore more detail regarding BMI and functional status.

Recovery symptoms were positively correlated with functional status. Although there have been no previous studies investigating the relationships between recovery symptoms and functional status in Thai TKR patients after surgery, the findings of this study indicated that TKR patients who had severe recovery symptoms also had greater negative functional status.

Findings of this study concurred with previous studies highlighting that postoperative pain of TKR was associated with functional status. Pain had a negative impact on ability to work outside the house and do household chores, and disrupted sleeping and daily living activities. Furthermore, quadriceps muscle weakness after TKR also significantly affected functional status and quality of life.<sup>3</sup> In addition, previous studies have reported that anxiety or depression was also related to functional status and patients with better mood states also had significantly better functional status.<sup>23</sup>

## CONCLUSION

In summary, these findings provided a beginning explanation of the phenomena of early recovery in a specific culture of Thai patients post TKR surgery. The results have revealed that recovery symptoms were related to functional status. Therefore, nurses and health care team members should play an important role in assessing symptoms and their severity in TKR patients and offering advice on self-care practices at home to both patients and their caregivers to facilitate their recovery in the early recovery phase after hospital discharge. Interventions to improve functional status and relieve recovery symptoms are also recommended.

#### REFERENCES

- Kennedy LK, Newman JH, Ackroyd, CK, Dieppe PA. When should we do knee replacements? Knee. 2003 Jan;10(2):161-6.
- Heiberg KE, Bruun-Olsen V, Mengshoel AM. Pain and recovery of physical functioning nine month after total knee arthroplasty. J Rehabil Med. 2010 Jul;42(7):614-9.
- Mizner RL. Petterson SC, Clements KE, Zeni Jr JA, Irrgang JJ, Snyder-Mackler L. Measuring functional improvement after total knee arthroplasty requires both performance-based and patient-report assessments: A longitudinal analysis of outcomes. J Arthroplasty. 2011 Aug;26(5):728-37.
- Fitzgerald JD, Orav EJ, Lee TH, Marcantonio ER, Poss R, Goldman L, et al. Patient quality of life during the 12 months following joint replacement surgery. Arthritis Rheum. 2004 Feb 15;51(1):100-9.
- Su HH, Tsai YF, Chen WJ, Chen MC. Health care needs of patients during early recovery after total knee-replacement surgery. J Clin Nurs. 2010 Mar;19:673-81.
- Wright JG, Santaguida PL, Young N, Hawker GA, Schemitsch, E, Owen JL. Patient preferences before and after total knee arthroplasty. J Clin Epidemiol. 2010 July;63:774-82.
- Sharkey PF, Miller AJ. Noise, numbness, and kneeling difficulties after total knee arthroplasty. J Arthroplasty. 2011 July;8(2):1427-31.
- Parvizi J, Han SB, Tarity TD, Pulido L, Weinstein M, Rothman RH. Postoperative ileus after total joint arthroplasty. J Arthroplasty. 2008 Apr;23 (3):360-5.
- American Academy of Orthopaedic Surgeons [internet]: Total knee replacement. [ited 2011 Dec 3]. Available from:http://orthoinfo.aaos.Org/ topic.cfm?topic=A00389
- Parsley BS, Bertolusso R, Harrington M, Brekke A, Noble P. Influence of gender on age of treatment with TKA and functional outcome. Clin Orthop Relat Res. 2010 Jul;468(7):1759-64.
- Hernández-Vaquero D, Fernández-Carreira JM, Pérez-Hernández D, Fernández-Lombardía J, García-Sandoval MA. Total knee arthroplasty in the elderly. Is there an age limit? J Arthroplasty. 2006 Apr;21(3):358-61.
- Harms S, Larson R, Sahmoun AE, Beal JR. Obesity increases the likelihood of total joint replacement surgery among younger adults. Int Orthop. 2007 Feb;31:23-26.
- Vincent HK, Vincent KR. Obesity and inpatient rehabilitation outcomes following knee arthroplasty: a multicenter study. Obesity. 2008 Jan;16(1): 130-6.
- Unver B, Karatosun V, Bakirhan S. Effects of obesity on inpatient rehabilitation outcomes following total knee arthroplasty. Physiotherapy. 2008 Sep;94(3):198-203.
- Polit DF, Back CT. Nursing research: Generating and assessing evidence for nursing practice. 9<sup>th</sup> ed. Philadelphia: Lippincott Williams & Wilkins; 2012.
- Irrgang JJ, Snyder-Mackler L. Wainner RS, Harner CD. Development of a patient-report measure of function of the knee. J Bone Joint Surg Am. 1988 Aug;80(8):1132-45.
- Artinian NT, Duggan C, Miller P. Age differences in patient recovery pattern following coronary artery bypass surgery. Am J Crit Care. 1993 Nov;2:453-61.
- Kuptniratsaikul V, Rattanachaiyanont M. Validation of a modified Thai version of the Western Ontario and McMaster (WOMAC) osteoarthritis index for knee osteoarthritis. Clin Rheumatol. 2007 Oct;26(10):1641-5.
- Arden NK, Arden E, Hunter D, Editors. The fact: osteoarthritis. New York: Oxford University Press; 2008.
- Boonstra MC, Malefijt MC, Verdonschot N. How to quantify knee function after total knee arthroplasty? Knee. 2008 Jul;15:390-5.
- Dahlen L, Zimmerman L, Barron C. Pain perception and its relation to functional status post total knee arthroplasty: A pilot study. Orthop Nurs. 2008 Jul-Aug;25(4):264-70.
- Garrett B, Walters J. Knee pain, swelling and stiffness after total knee replacement: a survey of South African knee surgeons. SA Orthop. J 2010;9:59-66.
- Gonzalez Sáem de jada M, Escobar A, Herrera C, Carrcia L, Aizpuru F, Sarasqueta C. Patient expectations and health- related quality of life outcomes following total joint replacement. Value Health. 2010 Jan-Jul;13 (4):447-54.